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Stabilization of Soil Using Jute Fiber and Stone Dust

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ABSTRACT: Due to the rapid development of the population and the industrialization of the world, the development movement is increasing significantly. Urban areas and cities are getting closer every day. There will be a shortage of land for the development of structures, distances, interstate highways and runways. The accessible land here and there may not yet be suitable for development training due to the limited land. Must be built in that position. Ground improvement technology is being evaluated to overcome these problems. Ground adjustments, for example, have been done by ground engineering engineers in recent decades. Many soil stabilizers that have been used to improve soil quality are concrete, lime, gypsum, fly debris, chaff debris, jute fibers, biocomposite stone residues, and more. For the work of this paper, we have chosen two soil stabilizers jute fiber and stone powder. To improve the geotechnical properties of the soil, it included jute fibers separately from the changing material. Soils accessible from the Srinagar region are being used for the work of the thesis. To find out the properties of the soil, 21 specimens are prepared, of which 15 specimens are 30,60,90mm long jute fiber 0%, 0.25%, 0.50%, 0.75%, 1%, and the remaining 6 specimens are added . It is prepared by adding 0%, 10%, 20%, 30%, 40% and 50% stone dust respectively. A CBR (California Bearing Ratio) test was performed on all specimens, and the results are presented in this paper. According to the results, it was found that the maximum increase in CBR value of 90 mm long and 2 mm diameter fibers was 1% fiber content, which was 200% higher than that of ordinary soil.

KEYWORD: MDD, CBR, Jute Fibre, stabilization, OMC

I. INTRODUCTION

Soil is an extended term commonly used in geotechnical design applications that remembers all the storage of free materials for the outside world created by the continuous procedure and decomposition of basic rocks. Despite the fact that durability occurs on a geological scale and the procedure progresses non-stop and steadily changes the soil. The physical, mixed, and organic procedures that make up a soil generally move along time, area, and natural conditions, resulting in a wide range of soil properties, whether or not they are equal in area. Physical durability occurs when hidden stone formation is destroyed by temperature changes at high and low temperatures, decomposition, exchange freeze-thaw, and movement of plants and organisms, whereas synthetic durability is oxidized. Degradation of rock minerals by various procedures such as reduction, hydrolysis, and carbonization.

METHODS OF SOIL STABILIZATION

Coordination strategies can be characterized comprehensively in the two categories

- Stabilization without substances
- Stabilization with added substances

Mechanical stabilization: In this strategy for conditioning, improvement in soil properties is terminated by compacting the soil to a more dense state or by changing the degree of soil.

This can be done in two ways:

- Compaction
- Evacuation or Addition of soil particle

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- Blasting

Adjustment by waste: Since soil quality is affected by the condition of groundwater as it depends on the strong concerns of the soil, the following methods should be used to eliminate abundant pore water pressure.

- Outer burden application
- Electro-assimilation
- Warm inclination application

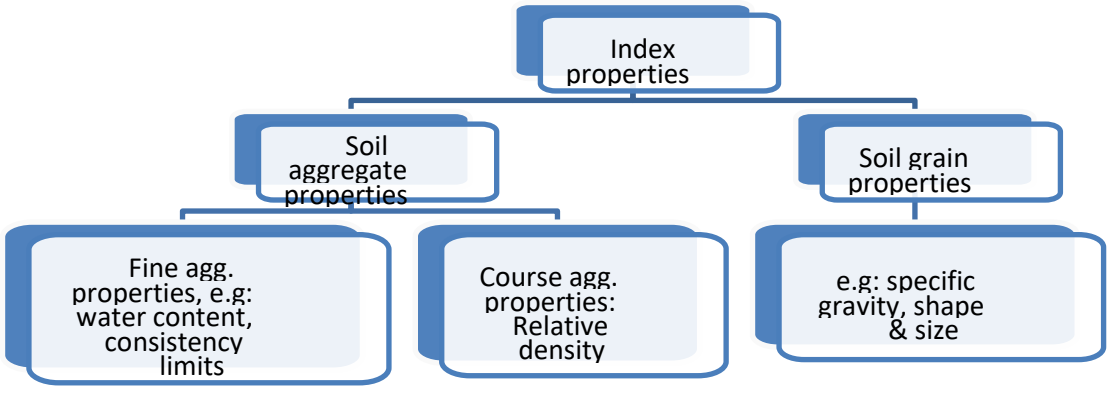
Ground Reinforcement: Techniques such as the following basically help extend the shear quality of the soil. :

- Soil nailing and stone sections
- Geo-synthetics
- Grouting

Many of these additives have recently been used in a variety of soil types with varying performance. An added substance may agree that it builds the properties of the soil, but cannot satisfy all prerequisites at the same time. You can check the adequacy of the soil to achieve the desired result, and gradually notice one added substance. Some commonly used strategies are given below:

- Cement Stabilization
- Lime Stabilization
- Bitumen Stabilization
- Salt Stabilization
- Fly-debris Stabilization
- Jute fiber adjustment
- Bio-catalyst adjustment and so on

Determination of an appropriate strategy depends on the type and level of progress required, the type and quality of soil, the toughness of the material, including possible contamination of sea groundwater assets to adjacent structures, the time to access the project, site conditions and associated costs.



INDEX PROPERTIES OF SOIL

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II. MATERIALS & METHODOLOGY

Primary and secondary binders form cementitious composites when in contact with water, or when reacting with water in the presence of pozoran materials. Commonly used binders are:

- Cement
- Lime
- Gypsum
- Jute
- Fly ash
- Rice husk, ash
- Stone Dust
- Blast furnace slag etc.

The above materials can be used alone or in combination.

This paper is utilizing jute fibers and stone dust from locally available soil. A brief introduction to the material and its behavior follows.

JUTE FIBRE

Jute can be spun into a long, delicate glossy plant fiber, a coarse, hard thread. It is basically ordered from the recently mallow family, made from plants of the genus Tsunaso, previously ordered in the oleaceae. The essential source of fiber is Corchorusolitorius but is considered substandard compared to Corchoruscapsularis. Jute is the name of the plant or fiber used to make burlap, hessian, or burlap. Jute is one of the most affordable plain strands, and rivals the assortment of guns and hires provided. Jute fibers are mainly made of plant materials cellulose and lignin. It has been classified as a bast class (fiber collected from tough skin, sometimes referred to as “skin” in the phloem of plants), along with kenaf mechanical hemp, flax (material), ramie, etc. The modern term for jute fiber is coarse jute. The strands are grayish to brown in color and are 1-4 meters (3-13 feet) long. Jute is said to be an equally gorgeous fiber for its shading and high-money respect.

TYPES OF JUTE FIBRES

For the purpose of general practicality, jute items are divided into four production classes. Hessian or Burlap: 5-12 oz plain weave texture. A garden made from high-quality jute sweet potatoes. It is used for various purposes such as fabric structure and sacks.

Sacking: Sacking cloth also known as heavy goods, made from lower grades of jute fibres. Bag cloth, also known as heavy, made of lower grade jute fiber. Sacking is a heavy, loosely squeezed fabric in plain weave or twill weave, with a variety of widths of 1520 ozs per yard. Sacking cloth Used for jute bags that wrap grains, sugar, cement, etc. in the weight range of 50-100 kg. The different qualities of this category are A. Twill, D.W Flocer, Cement Bags etc.

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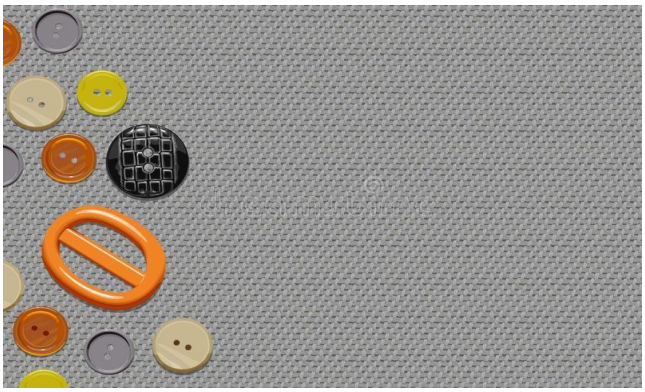
Hessian Jute fibre

Sacking jute fibre



Canvas jute fibre

Jute yarn and twine

STONE DUST

It's a modern side effect. Crushing stone crushing. The shades are dark, similar to the whole. Remnants of the stone were retrieved nearby by a spore crusher. Natural problems arise, such as damping problems. Converting stones into valuable result stone residues has many advantages, such as natural equalization support. It is also used for various exercises in the development industry such as the development of Street and the manufacture of building materials such as lightweight totals, blocks and tiles. 1.18mm IS trainer. Stone residue, also known as stone screening, is the best type of crushed stone. Manufactured using similar types of stones as the other two types, but cracked into powder. At the point of use, in the absence of anyone, the stone residue forms a hard surface that is water-safe. When utilized in large stones, it acts as a coupling expert. In view of their ability to form hard, impermeable surfaces, stone residues are often used in the middle of garden and walkway stones and blocks. This application not only protects the foundation of the area from moisture, but also prevents vomiting and the development of morphology, but likewise, it adequately protects weeds and grass growth among the pavement. Baba, biking and hiking trails and trails meet the same requirements. Remnants of stone are, of course, used as concrete or asphalt coupling operators in roads, car ports and sidewalks.

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Locally available stone dust

SOIL

Soil is a mixture of rocks, mineral particles, water and air. It is based on these components that the characteristics of the soil start in one region and change to the next. In addition, various types of soil are used for development work. The type of soil at the construction site affects the structure and cost of the structure to be built.In this context, soil surveys help determine if additional work is required to set up the development site. Similarly, unique types of soil require a variety of facilities to ensure a stable development process. For example, sandy soil needs to be included to develop partitions to set the structure in order for the sand to be installed and maintained. Mud and sand can be avoided or expanded depending on the water content of the facility, so additional materials are required for the facility, and the boundary line is broken along these lines to build the development building. Can be done.

III EXPERIMENTAL PROCEDURE

MATERIAL COLLECTION : Following materials are collected and used.

- **SOIL**

The soil used for the study was natural soil from Srinagar, Jammu and Kashmir. Soil samples were collected at a depth of 60 cm after removing the topsoil from the natural ground. Nearly 10 kg of locally available clay soil was collected and thoroughly hand-sorted to remove plant material and pebbles. Next, I made the soil 4.75 mm and removed the gravel part. The soil was oven dried for 24 hours before performing geoengineeringtests.

- **JUTE FIBRE**

The jute fiber used was procured from Delhi. The diameter of the jute fibers used was 2 mm. This fiber was cut to lengths of 30 mm, 60 mm and 90 mm to carry out our research. Jute fibers are generally provided in the form of threads. These are fibers that are mechanically woven with very fine threads. Jute fiber was used. Jute fiber is mixed with locally available soil in various proportions of 0%, 0.25%, 0.50%, 0.75% and 1% based on the dry weight of the soil.

Properties of experimental fibrephotograph of 30 mm jute fibre

Fibre length, mm	30, 60 and 90.
Fibre diameter in mm	2
Specific Gravity of fibre	1.3
Bulk Density in kg/m^3	1300
Ultimate tensile strength in N/mm^2	3400

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STONE DUST : The exponential properties of stone powder were determined based on the IS code. It was randomly mixed with 10%, 20%, 30%, 40% and 50% soil samples of dry soil weight. Stone powder was obtained from SM Stone crusher, Srinagar. The percentage of this substance was 0.50% as measured at 2.50. Stone powder used for soil that passes through 90 micron IS bodies.

S.No.	Properties of stone dust	value
01	Grain size distribution Course sand(2-4.75mm)% Medium sand (0.425 – 2mm)% Fine sand (0.075 – 0.425mm)% Silt (0.002 – 0.075mm) and Clay (<.002mm) %	 8 35 43 14 0
02	Compaction characteristics Maximum dry density gm/cm3 Optimum moisture content %	 1.91 11.20
03	Specific gravity	2.76
04	Soaked CBR value %	8.03

Physical propertiesofstonedustPhotograph of stone dust

PROPERTIES OF SOIL

SM stone Crusher Rawalpora

Physical properties of parent soil

Specific gravity	2.42
Water content	12.20%
Liquid limit	19.70
Plastic limit	7.23
Plasticity index	12.47
CBR value	6.08

IV METHODOLOGY

Locally available Sri soil was selected for stabilization with jute fiber and stone dust. Various stone crushers in the vicinity are not fully utilizing these crusher byproducts. Stone dust is a by-product formed during stone grinding, and its demand does not reach its peak due to the limited use of stone dust. So, in order to increase the shear strength of the soil, I would like to use stone powder as a reinforcement material for the soil that is available locally. Here's the procedure I followed in the methodology: Confirmation of proper location in Srinagar region. Collection of soil samples from Srinagar, stone dust from SM Stone Crusher Sgr, and finally jute fibers from the market. Determination of CBR values of parent soils, soils fortified by varying jute fiber content and length, and soils fortified with stone dust. Compare the above results.

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V RESULTS AND DISCUSSIONS

This chapter presents the results of stabilizing vast lands using jute fiber. Increased strength standards are confirmed by performing a CBR test on soil samples with or without fiber reinforcement. This sample contains 0.25, 0.50, 0.75, and 1% dry mass of jute fiber. All samples were soaked in sodium chloride solution for 24 hours. CBR tests were performed on all samples of various soils with jute fiber content and the results were displayed numerically and graphically. This chapter shows the results of stabilization of the soil available in the area by quarrying. Stone dust was added in various proportions such as 10% by weight, 20% by weight, 30% by weight, 40% by weight, 50% by weight of the dry weight of the soil.

CBR Test

California bearing ratio tests were performed on soil reinforced with jute fibers of various lengths. The ratio of force per unit area required to penetrate a soil mass at a speed of 1.25 mm / min with a circular plunger with a diameter of 50 mm.

he following table gives the standard loads adopted for different penetrations for the standard material with a C.B.R. value of 100%.

Penetration of plunger(mm)	Standard Load (Kg)
2.5	1370
5.0	2055
7.5	2630
10.0	3180
12.5	3600

Standard CBR values

CBR Testing machine

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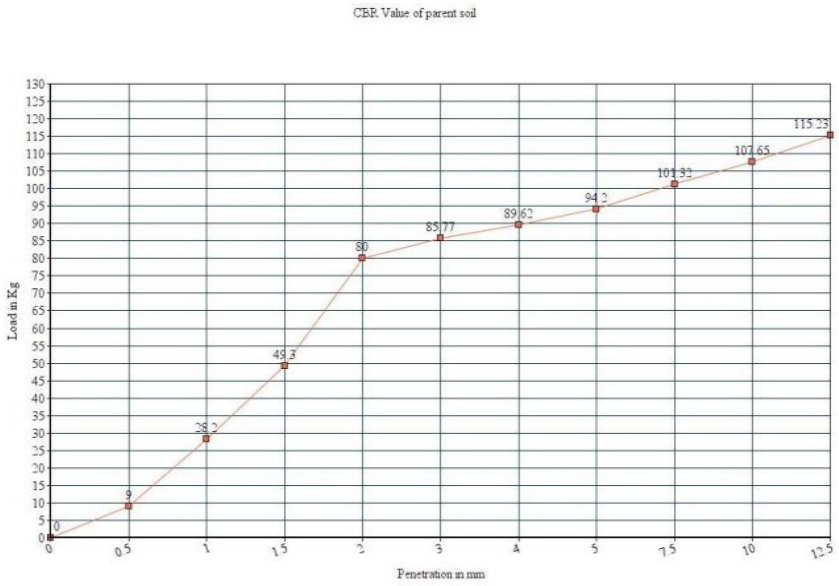
CBR Test on parent soil

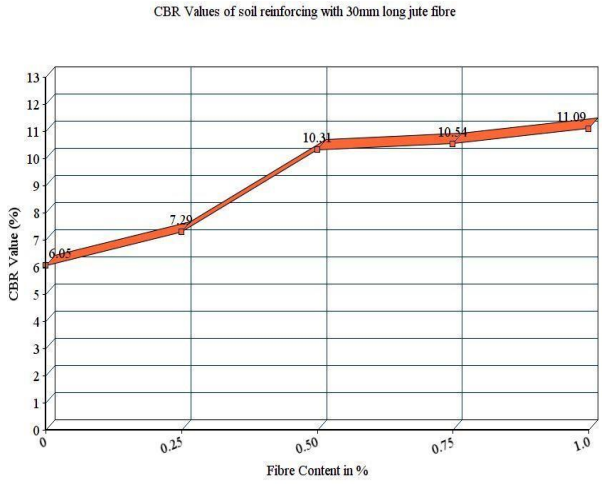
Penetration in mm	Load in Kg
0.00	0
0.50	9
1.00	28.20
1.50	49.30
2.00	80
3.00	85.77
4.00	89.62
5.00	94.02
7.50	101.32
10.00	107.65
12.5	115.23



CBR values of parent soil

CBR Test on soil reinforced with jute fibre only: At 2.5mm penetration CBR value = (80+85.77/2) *100/ 1370 =6.05 At 5mm penetration CBR value = 94.02*100/2055 =4.57 Therefore, the higher value of 6.05 in the above values is used as the CBR value of the parent soil.

Length of jute fibre (mm)	**%age of fibre by dry weight of soil**	**CBR value (%)**	**%age inci CBR value r**
30	0%	6.05	------
30	0.25%	7.29	20.56%



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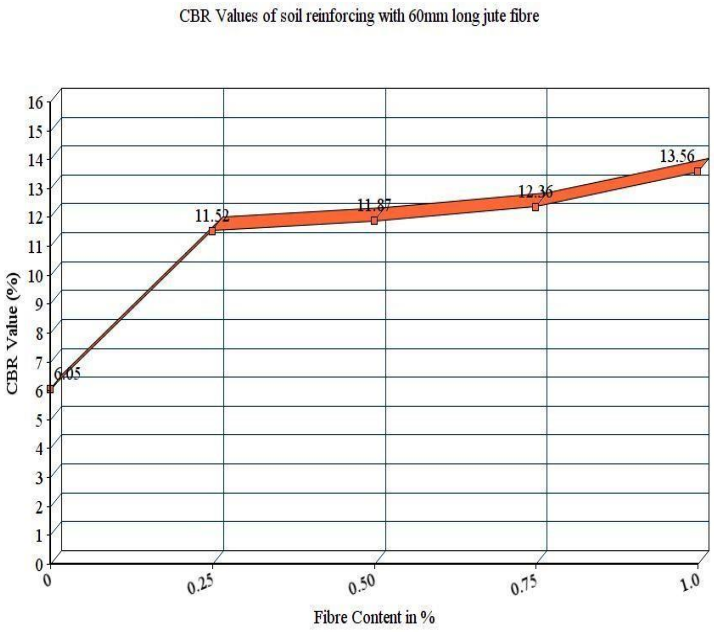
30	0.50%	10.31	70.41%
30	0.75%	10.54	74.21%
30	1 %	11.09	83.30%

CBR values of soil reinforcing with 30mm long jute fibres

Length of jute fibre (mm)	**%age of fibre at dry weight of soil**	**CBR value (%)**	**%age incin CBR value**
60	0%	6.05	---------
60	0.25%	11.52	90.41%
60	0.50%	11.87	96.20%
60	0.75%	12.36	104.29%
60	1 %	13.56	124.13%



CBR value of soil reinforced with 60mm long jute fibres

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Length of jute fibre (mm)	%age of fibre by dry weight of soil	CBR value (%)	%age increase in CBR value
90	0%	6.05	----------
90	0.25%	13.50	123.14%
90	0.50%	13.67	125.95%
90	0.75%	15.18	150.91%
90	1 %	18.24	201.49%

CBR values of soil reinforcing with 90mm long jute fibres

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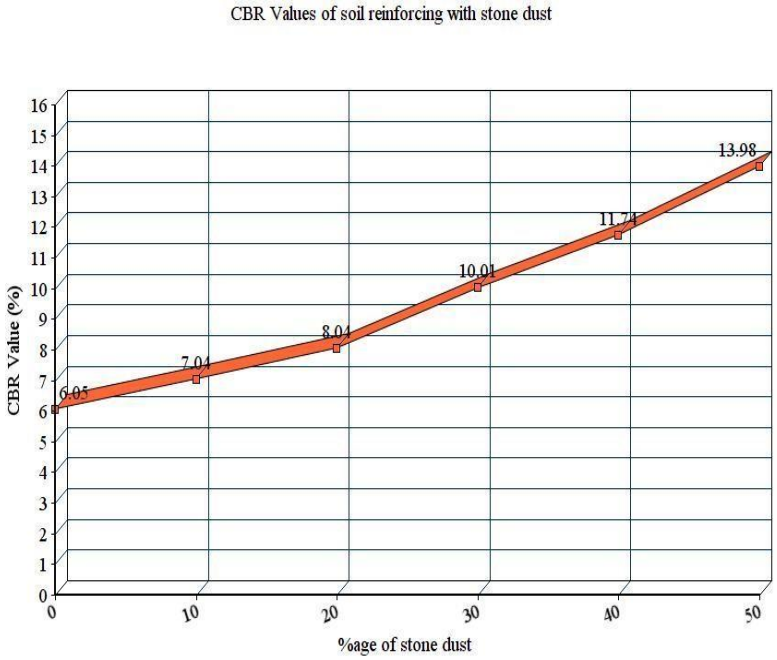
Comparison of results of all lengths of jute fibre:

Stone dust content	CBR Value	%age iin CBR value
0% stone dust	6.05	------
10% stone dust	7.04	16.36
20% stone dust	8.04	24.75
30% stone dust	10.01	65.45
40% stone dust	11.74	94.05
50% stone dust	13.98	131.07



CBR Test on soil reinforced with stone dust only

V CONCLUSION & FUTURE SCOPE

CONCLUSION:

• Soil CBR values increase with increasing length. It was found that the maximum increase in CBR value was increased by 200% or more compared to general soil at a fiber content of 1% of fibers having a diameter of 2 mm and a length of 90 mm. The CBR value increases as the length of jute fiber increases. Soil with a length of 30 mm and a fiber content of 0.25% has a 20.56% increase in CBR value, while soil with the same fiber content has a CBR value of 0.25% but a length of 90 mm , CBR value is increased by 123.14%. According to the results, the maximum increase in CBR value was 1% for fibers 90 mm long and 2 mm in diameter, which was several times (200%) higher than that of ordinary soil. Based on the above results, the optimum stone content is 50%, above which the CBR value can show a very low rate of increase. According to the results, even after adding 50% stone powder to the soil, the CBR value did not increase as much as adding 1% jute fiber, which is 90 mm in length. Overall, it can be concluded that fiber reinforced soils can be considered excellent ground improvement techniques, especially in weak soil engineering projects.

SCOPE OF FURTHER STUDIES

Improving soil properties has been the most important issue today. Efforts were made here to study the effects of jute fiber and stone powder. In this study, I limited my work to a maximum of 1% jute fiber content and 50% stone powder. Below are some suggestions for additional progress.

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- • Studies for soil stabilization may be conducted with 1% or more jute fiber.
- • Jute fiber and stone powder can be added at the same time in various contents.
- • In addition to the CBR exam, you can take a variety of tests.

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