SOIL STABLIZATION BY USING JUTE FIBER

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Abstract

Improvement of soil subgrades has always been area of concern for soil engineering .To strengthen the soil subgrades , I have used jute fibre which is advantageous because they are cheap, locally available, biodegradable and eco- friendly. I have mixed jute fibre with soil at diiferent lengths 40mm, 45mm and 50mm and at different percentage 0.5%,1%,1.5% and 2% and the daimeter if jute fibre is 2mm. From laboratory tests the effect of jute fibre was observed by finding the optimum value , bulk density and maximum dry density. they test were done by standard proctor tests. First soil which were taken by me were tested and calculated optimum value, bulk density and maximum dry density for the compersion. If the moisture content of soil is more dry density of soil were decreasing.

Keyword:

jute fibre, length ,diameter , percentage, standard proctor test.

1. Introduction

SOIL as considered by the engineer , is the complex material produced by the weathering of solid rocks .it consists of solid with varing amounts of water ,air or other gases and organic matter. Although soil may be looked upon as a first engineering material , its behaviours works cann't be predicted with nearly the same confidence as the behaviours of steel .concrete, wood and other common building materials .this is because of it heterogeneous nature.

Soil Stabilization

Soil Stabilization is the alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load bearing capacity of a sub-grade to support pavements and foundations. To improving soil strength and increasing resistance to softening by water through bonding the soil particles together, water proofing the particles or combination of the two (Sherwood, 1993). Usually, the technology provides an alternative provision structural solution to a practical problem.

Subgrade is the lowest layer of the pavement. It takes all the loads of the pavement as well as the loads coming on the pavement. So, it should possess sufficient stability under adverse climatic and loading conditions. The defects in black top pavement surface like rutting, corrugation, etc. are generally attributed to poor subgrade. Thus the stability of the pavement depends upon the stability of the subgrade. In order to enhance the engineering properties, soil can be reinforced using jute fibre. Jute fibre is preferable because of its better durability, high tensile strength and capacity to withstand rotting and heat, porous texture which gives it good drainage and filtration properties.

JUTE

Jute is a natural fibre popularly known as the golden fibre. It is one of the cheapest and the strongest of all natural fibres and considered as fibre of the future. Jute is second only to cotton in world's production of textile fibres. India, Bangladesh, China and Thailand are the leading producers of Jute. It is also produced in southwest Asia and Brazil. The jute fibre is also known as Pat, Kosta, Nalita, Bimli or Mesta (Kenaf). Kenaf known as Mesta or Ambari (species Hibiscus Cannabinus) is also considered as a variety of Jute. It is cultivated in Indian subcontinent, Thailand, China and Africa. The two main types of jute, white jute (Corchorus Capsularies)and dark jute or Tossa (Corchorus Olitorius) are grown in India, Bangladesh, Thailand, China, south Asian countries and Brazil. India is the largest producer of jute goods in the

world, while Bangladesh is the largest cultivator of raw jute. Temperate, wet and humid climate of Bangladesh are very conducive to the growth of jute.

2. Material and Methods

2.1 MATERIAL USED

2.1.1 Soil

The soil used in the investigation was the natural soil collected from in college campus of ACET Amritsar, Punjab. The soil sample was collected from a depth of 60 cm after removing the top surface soil from natural ground surface

2.1.2 Jute Fibres

The jute fibre used was procured from the local market. The diameter of the jute fibre used was 2mm. These fibres were cut in the lengths of 40mm, 45mm and 50mm for thesis. Jute fibres are generally available in the threaded form. These are mechanically woven fibres with very fine threads.

Methodology

a) Identification of suitable site.

b) Collection of soil samples.

c) Determination of dry density of soil by carrying standard proctor test.

d) Jute samples using different percentages of jute fibre of lengths 40mm, 45mm,50mm.

e) Determination of dry density of soil and jute by carrying standard Proctor test.

f) Determination of Atterberg limits

g) Determination of type of soil by Grain Size Analysis

3. Results

Result of Grain size Analysis

Total weight of soil =500gm

Table 1: Grain Size Analysis

I.S sieve number or size in mm	Wt. Retained in each sieve (gm)	Percentage on each sieve	Cumulative %age retained on each sieve	% finer	Remarks
4.75 mm	157	%	31.4	68.1	
2.36 mm	70	14	45.4	54.6	
1.18 mm	50	10	55.4	44.6	
600µ	66	13.2	68.6	31.4	
300 µ	100	20	88.6	11.4	
150 µ	45	9	97.6	2.4	
75 µ	4	0.8	98.4	1.6	
Pain	6	1.2	99.6	0.4	

Result of Liquid Limit and Plastic limit

Total Weight of Sample=150gm

Weight of water added =40mm

Table 2:-Result of liquid limits

Sample number	01	02	03	04
Container number	A	B	C	D
Number of Blows	19	20	26	31
Mass of empty container (A), gm	27	27	27	27
Mass of container + wet soil (B), gm	44	41	52	49
Mass of container + dry soil (C), gm	40	39	46	43
Water content, {D=(B-C)},gm	4	2	6	6
Weight of Dry Oven Soil ,{E=(C-A)},gm	13	12	19	19
Moisture Percentage=D/E*100	30.77%	16.67 %	31.58%	31.58%

Result of Plastic Limit

Table 1:-Result of standard proctor test

Number of Container	A	B
Weight of empty container (A) gm	27	27
Weight of container + wet soil (B) gm	40	47
Weight of container + dry soil (C) gm	36.2	43.5
Water content {D=(B-C)}	3.80	3.50
Weight of Dry Oven Soil {E=(C-A)}	9.2	16.5
Moisture Percentage=(D/E)*100	42.2%	21.21%

Result of Soil by Standard Proctor Test

Wt. of mould with stand=5.359 Kg

Wt. of soil=2.5 Kg

Table 4:-Result of standard proctor test

Sr. No.	1	2	3	4	5	6
Wt. of Mould+ Soil (Kg)	6.165	6.272	6.306	6.415	6.264	6.242
Moisture Content	6%	8%	10%	12%	14%	13%
Wt. of Soil(gm)	1840	1947	1981	2090	1939	1917
Volume(cc)	1000	1000	1000	1000	1000	1000
Bulk Density(gm/cc)	1.840	1.947	1.981	2.090	1.939	1.917
Dry Density(gm/cc)	1.735	1.802	1.825	1.866	1.700	1.696

Result of Soil With Jute Fibre length of 40mm by Standard Proctor test

By adding jute with soil I put the length of jute 40mm and by varying the percentage of jute fibre. Weight of the mould with stand=4.302kg, Total weight of sample =2.5kg

Table 2:-*Jute fibre of 40mm*

Jute %	Wt of Mould + Soil + Jute	Moisture Content %	Wt of Soil + Jute (gm)	Volume (cc)	Bulk Density (gm/cc)	Dry Density $\gamma d=\gamma b/1+w$
0.5	6.187	14%	1867	1000	1.867	1.637
	6.285	15%	1965	1000	1.965	1.708
	6.325	16%	2005	1000	2.005	1.728
	6.300	17%	1980	1000	1.980	1.692
1.0	6.197	16%	1877	1000	1.877	1.618
	6.286	17%	1966	1000	1.966	1.680
	6.343	18%	2023	1000	2.023	1.714
	6.288	19%	1968	1000	1.968	1.653
1.5	6.272	16%	1952	1000	1.952	1.682
	6.345	17%	2025	1000	2.025	1.730
	6.350	18%	2030	1000	2.030	1.720
	6.320	19%	1941	1000	1.941	1.644
2.0	6.167	18%	1847	1000	1.847	1.565
	6.241	20%	1921	1000	1.921	1.600
	6.249	21%	1929	1000	1.929	1.594
	6.240	22%	1920	1000	1.920	1.573

Result of Soil With Jute Fibre by Standard Proctor test

By adding jute with soil I put the length of jute 45mm and by varying the percentage of jute fibre. Weight of the mould with stand=4.193kg, Total weight of sample =2.5kg

Table 3:-Jute fibre with 45mm

Jute %	Wt of Mould + Soil + Jute	Moisture Content %	Wt of Soil + Jute (gm)	Volume (cc)	Bulk Density (gm/cc)	Dry Density $\gamma d=\gamma b/1+w$
0.5	6.009	14%	1819	1000	1.819	1.595
	6.104	15%	1911	1000	1.911	1.661
	6.130	16%	1937	1000	1.937	1.669
	6.141	17%	1948	1000	1.948	1.664
	6.135	18%	1943	1000	1.943	1.645
1.0	5.950	16%	1397	1000	1.397	1.504
	5.988	17%	1795	1000	1.795	1.534
	6.120	18%	1927	1000	1.927	1.633
	6.134	19%	1941	1000	1.941	1.631
	6.140	20%	1947	1000	1.947	1.622
	6.132	21%	1939	1000	1.939	1.602
1.5	5.950	16%	1757	1000	1.757	1.687
	6.075	17%	1882	1000	1.882	1.694
	6.121	18%	1928	1000	1.928	1.633
	6.077	19%	1904	1000	1.904	1.600
2.0	6.017	17%	1824	1000	1.824	1.558
	6.034	18%	1841	1000	1.841	1.560
	6.051	19%	1858	1000	1.858	1.575
	6.102	20%	1909	1000	1.909	1.590

	6.123	21%	1930	1000	1.930	1.595
	6.104	22%	1911	1000	1.911	1.566

Result of Soil With Jute Fibre by Standard Proctor test

By adding jute with soil I put the length of jute

50mm and by varying the percentage of jute fibre.

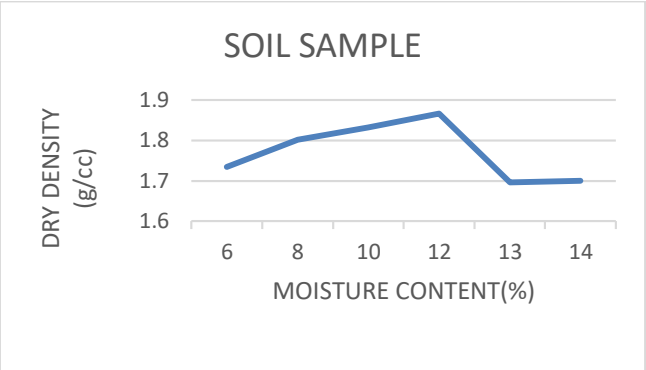
Weight of the mould with stand=4.193kg,

Total weight of sample =2.5kg

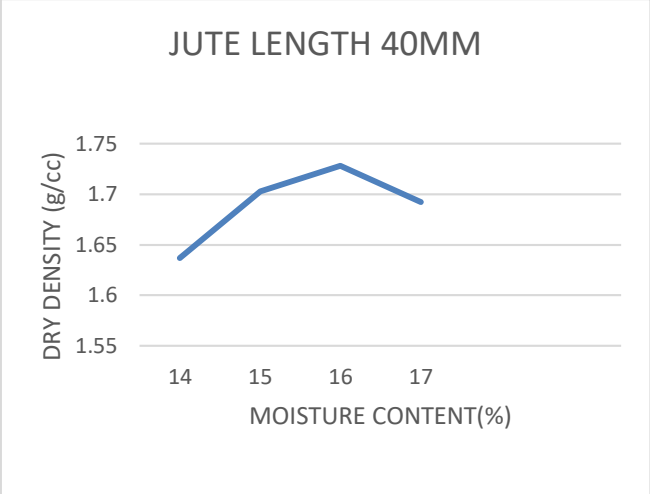
Table 4:-Jute fibre of 50mm

Jute %	Wt of Mould + Soil + Jute	Moisture Content %	Wt of Soil + Jute (gm)	Volume (cc)	Bulk Density (gm/cc)	Dry Density $\gamma d=\gamma b/1+w$
0.5	6.111	11%	1918	1000	1.918	1.727
	6.154	13%	1961	1000	1.961	1.735
	6.223	15%	2030	1000	2.030	1.765
	6.172	17%	1980	1000	1.980	1.692
	6.152	18%	1959	1000	1.959	1.660
1.0	5.923	11%	1730	1000	1.730	1.558
	6.027	13%	1834	1000	1.834	1.623
	6.093	15%	1900	1000	1.900	1.652
	6.182	17%	1989	1000	1.989	1.700
	6.168	18%	1975	1000	1.975	1.673
	6.173	19%	1980	1000	1.980	1.663
1.5	6.082	16%	1889	1000	1.889	1.628
	6.125	17%	1932	1000	1.932	1.651
	6.157	18%	1964	1000	1.964	1.664
	6.166	19%	1973	1000	1.973	1.657
	6.130	20%	1937	1000	1.937	1.644
2.0	5.968	16%	1775	1000	1.775	1.530
	6.102	18%	1909	1000	1.909	1.617
	6.116	20%	1923	1000	1.923	1.602
	6.131	21%	1938	1000	1.938	1.601
	6.112	22%	1919	1000	1.919	1.572

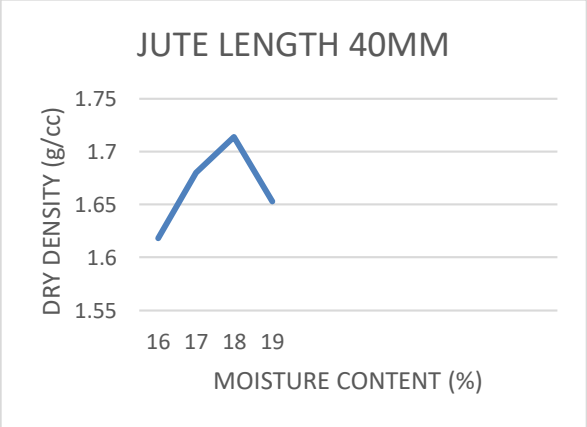
4. GRAPHICAL REPRESENTATION



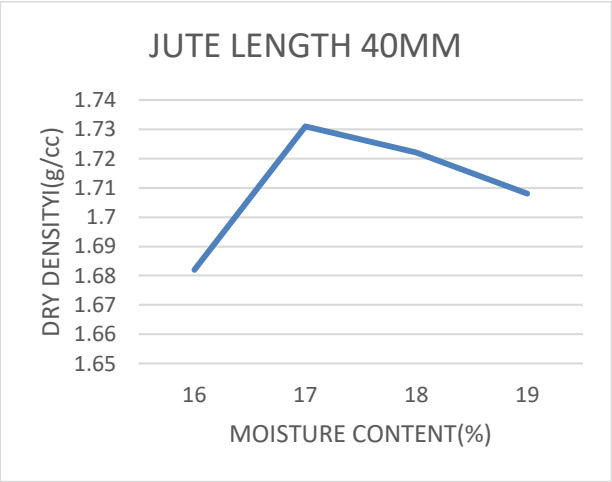
Graph 1:- Moisture content with dry density of soil sample



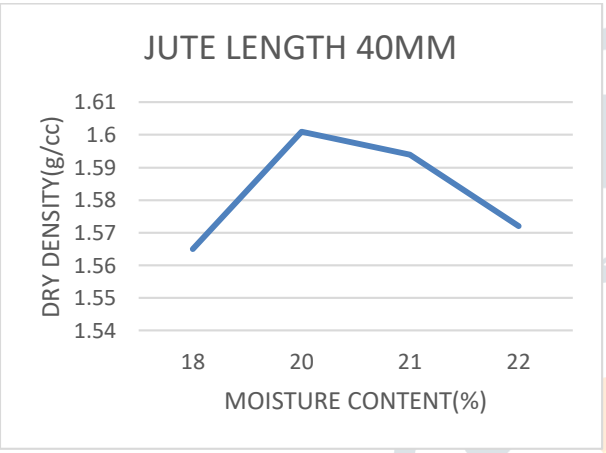
Graph 2:- Soil sample with 0.5% of jute fibre



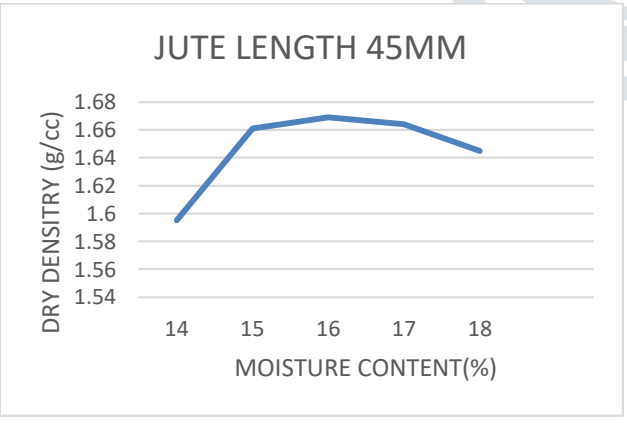
Graph 3:-Soil sample with 1.0% of jute fibre



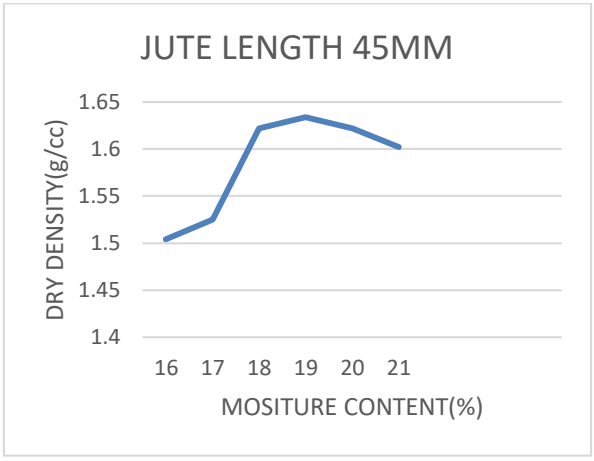
Graph 4:-Soil sample with1.5% jute fibre



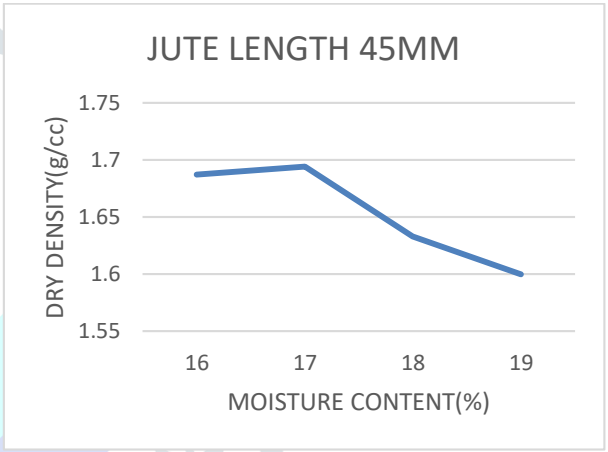
Graph 5:-Soil sample with 2% of jute fibre



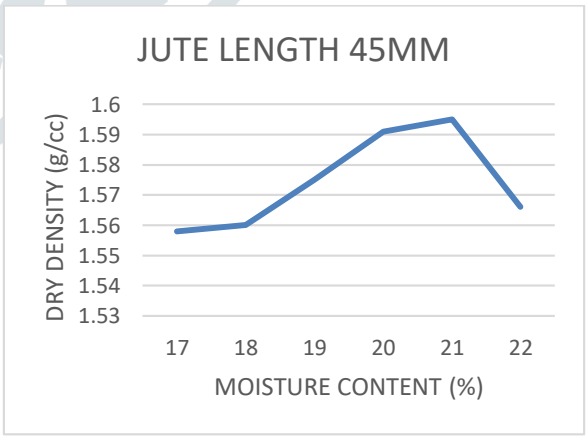
Graph 6:-Soil sample with 0.5% of jute fibre



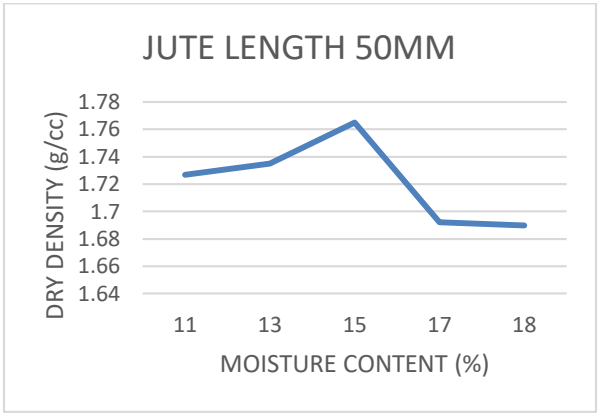
Graph 7:-Soil sample with 1.0% of jute fibre



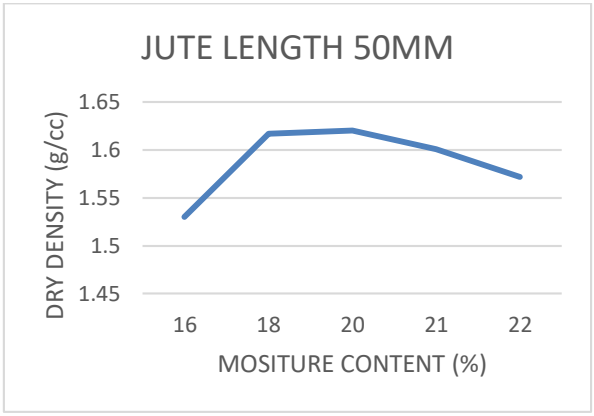
Graph 8:-Soil sample with 1.5% of jute fibre



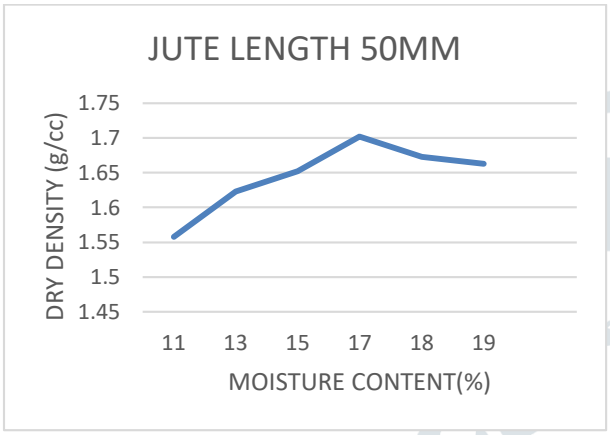
Graph 9:-Soil sample with 2% of jute fibre



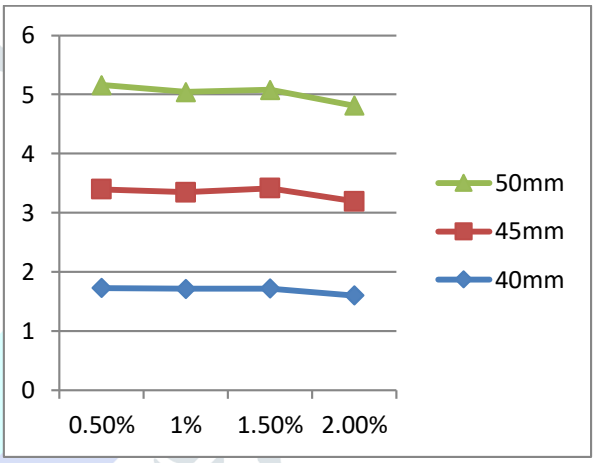
Graph 10:-Soil sample with0.5% of jute fibre



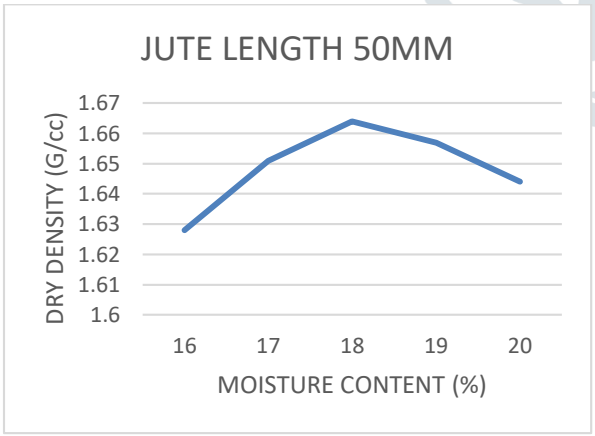
Graph 13:-Soil sample with 2% of jute fibre



Graph 11:-Soil sample with 1% of jute fibre



Graph 14:-Comparing the results



Graph 12:-Soil sample with 1.5% of jute fibre

4 CONCLUSION

- As we increase the jute percentage and increase moisture content the dry density start decreasing that indicate we cann't use these jute fibre where the moisture content in the soil is more.

- Jute should be used where we moisture content of soil is less

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As we increase the jute percentage

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