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Stabilization of subgrade soil with lime and coir

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ABSTRACT

The establishment of any nation majorly depends upon the transportation, import and export. One in every of the big transport systems that connects all the agricultural and concrete area is pavement. Rumenerative of road leads to increases country's profitable growth with full load acting upon the road would be evenly distributed between these sub-graded layer, because the clayey loam has low limit of capacity thus abundant material such as cocunut coir and lime can be used to the strength of the sub grade layer. The clayey soil goes through unrestrained volumetric changes making their utilization within the construction engineering science project burdensome. The properties of clay particle will be modified in many ways such as mechanically, chemically as well as thermally. Thus stabilzation of soil techniques is necessary in order to gain stability of the soil so that it can easily withstand the loads acting upon the super-structure.

Keywords: Bearing Capacity, Stabilization of Soil, Shear Strength, Coconut Coir, Lime

1. INTRODUCTION

Problems linked with the physical appearance of roads are the effect of continous swelling,repitatively acting of loads and absoption of sub-soil and frost action. Clays are considered as the problematic deposits for civil engineering constructions since they are susceptible for volume change due to seasonal moisture variation and temperature.

Therefore stabilization of clay is essential for supporting the foundation of the structure. Stabilization technique may be mechanical or chemical, or both. In present work, the possibility of stabilizing soil with chemical stabilizers lime and physical stablizers coconut coir are investigated. Soil Stabilization is not new, in recent years scientific methods have been applied in soil stabilization. The stabilization increases strength as well as resilence of the soil. The strength of clayey soil is expressed in units of compaction, strength of shear, and load holding capacity. Durability is expressed in terms of absorption, reduction in strength, or in terms of direct resistance to freezing and thawing. Innovative soil stabilizations have great demand in present world.

2. METHODOLOGY

• Laboratory test conducted:

With dfferent percentage of lime added with clayey soil ,CBR test was conducted in order to find out the optimum lime percentage.The testing phenomena was conducted lime was added with soil with separate lime content like 2, 4 and 6 percent by weight was used for making samples mixed in powdered form.

The compaction study was followed by CBR tests. In second phase combination of compaction and California bearing test was conducted by mixing 0.5%, 1%, 1.5% and 2% of COIR Fibres mixed with clay soil and optimum percentage of lime (4%) materials for finding optimum percentage of coir fibers.

• CBR tests:

Theoretically the CBR test measures and compare the load bearing capacity or the strength of cohesive material having the particle size of 20mm.

Test is used to evaluate the sub grade strength of the road and pavement .The CBR value changes with moisture content. So CBR value is calculated when sub grade is in moist condition.



3. COMBINED CALIFORNIA BEARING RATIO TESTS

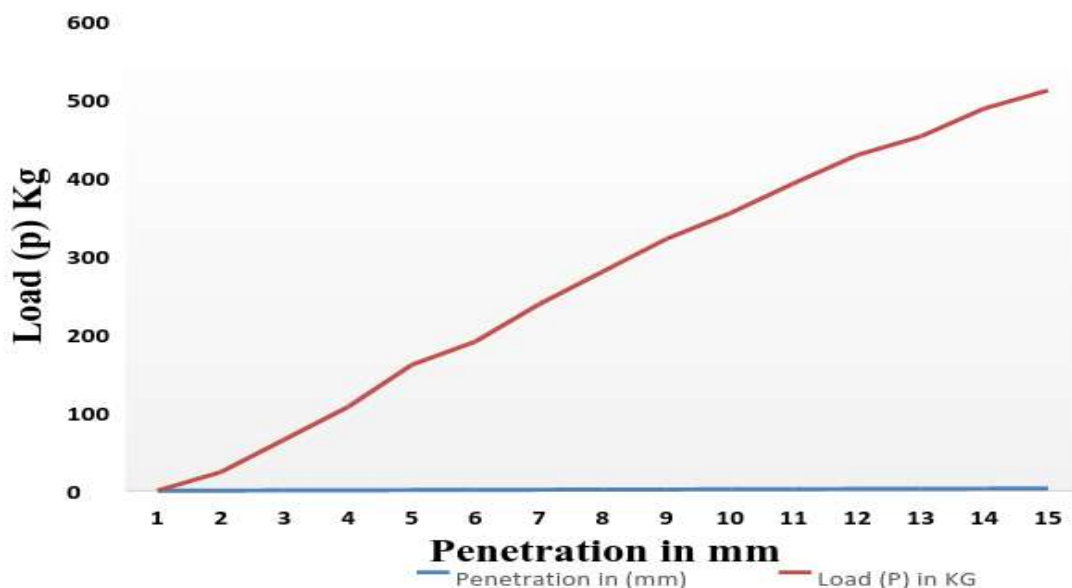
The percentage of lime to be added to soil is between 1% to 6% and coir 0.25%, 0.50%, 0.75%, 1% Clayey soil was treated with 2% and 4% of lime for the CBR test.

Similarly, soil was treated with 0.5% coir and 1% coir for CBR test.

Hence, an attempt has been made to combine both lime and coir with their optimum dosages for economy so as to achieve the maximum required CBR strength.

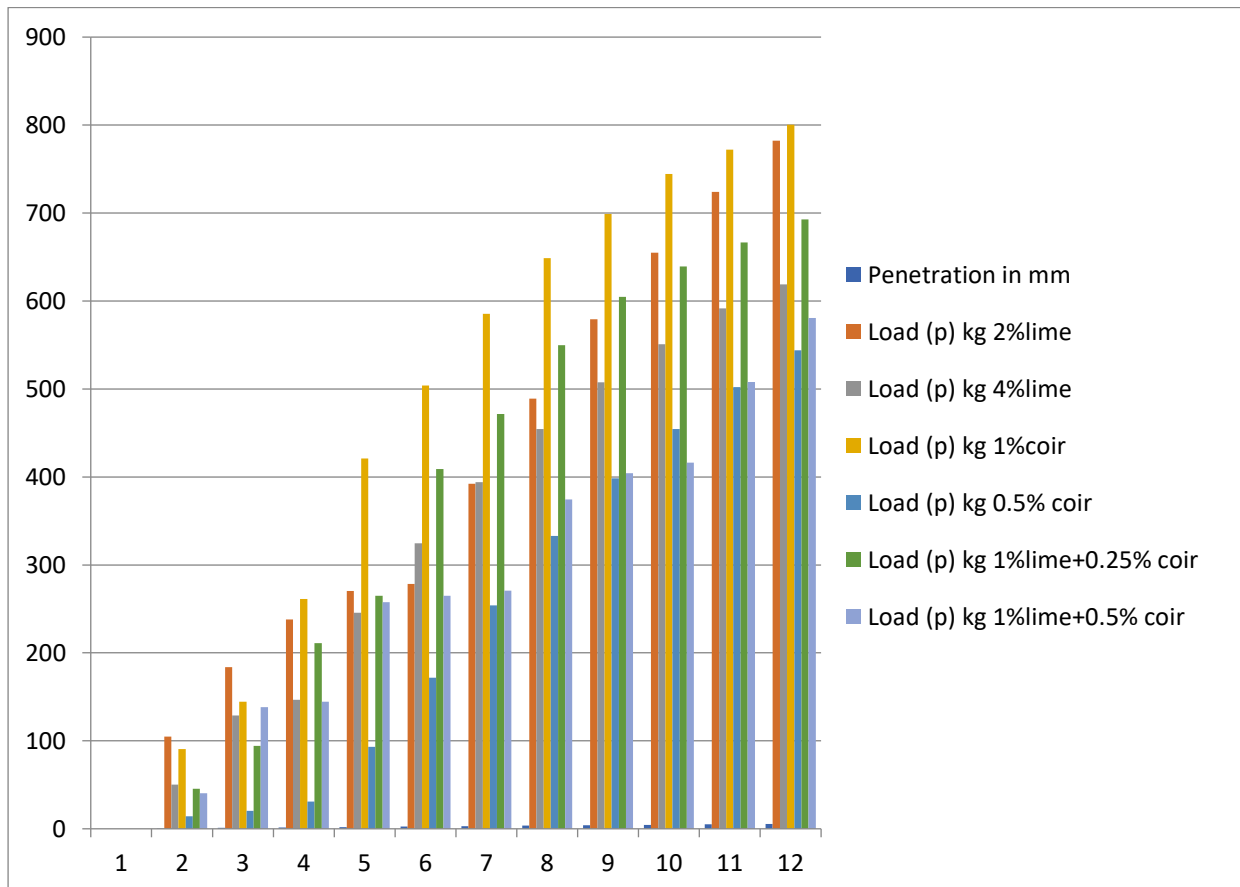
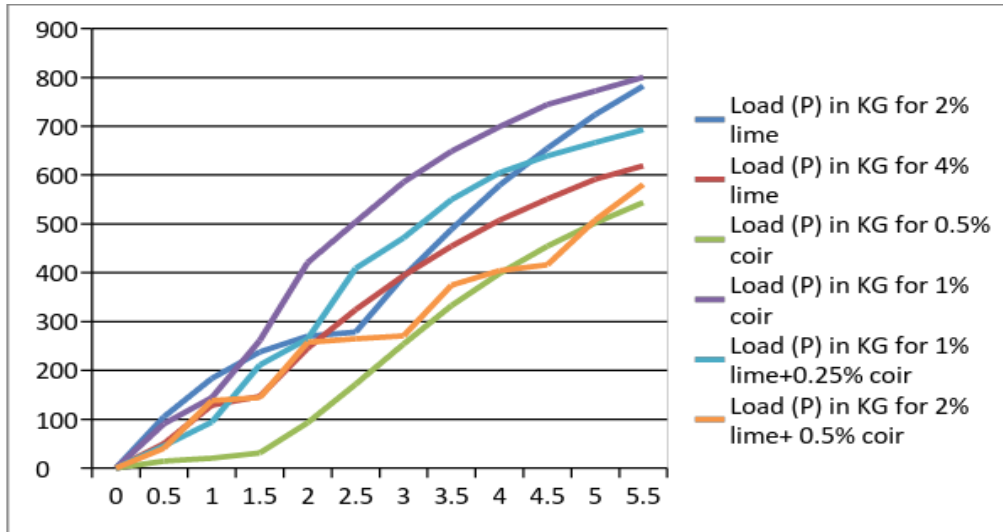
4. CBR VALUE OF CLAYEY LOAM

Reading on dial guage		Reading on proving		Load acting upon (P) in Kgs
DIV	DIV*LC	DIV	DIV*PRC	
-	-	-	-	-
20	0.2	4	234	23.85
40	0.4	11	643.5	65.59
60	0.6	18	1053	107.33
80	0.8	27	1579.5	161.00
100	1.0	32	1872	190.82
120	1.2	40	2340	238.53
140	1.4	47	2749.5	280.27
160	1.6	54	3159	322.01
180	1.8	59.2	3480.75	354.81
200	2.0	66	3861	393.17
220	2.2	72	4212	429.35
240	2.4	76	4446	453.21
260	2.6	82	4797	488.99
280	2.8	86	5031	512.14



5. OVER ALL STRENGTH COMPARISION WITH ADDITION OF LIME AND COIR

Penetration in mm	Load (p) kg 2%lime	Load (p) kg 4%lime	Load (p) kg 1%coir	Load (p) kg 0.5% coir	Load (p) kg 1%lime+0.25 % coir	Load (p) kg 1%lime+0.5% coir
0	0	0	0	0	0	0
0.5	104.95	50.09	90.64	14.31	45.55	40.55
1	183.66	128.8	144.31	20.27	94.22	138.34
1.5	237.93	146.69	261.19	31	211.1	144.31
2	270.23	245.68	421	93.02	264.77	257.61
2.5	278.48	324.4	503.89	171.7	409.01	264.77
3	392.38	394.17	585.59	254	471.44	270.73
3.5	488.99	454.4	648.8	332.8	549.81	374.49
4	579.3	507.47	698.89	398.3	604.67	404.31
4.5	654.77	551	744.44	454.4	639.26	416.23
5	723.94	591.55	772.24	502.1	666.69	508.07
5.5	782.38	618.99	800.27	543.9	692.93	580.82



6. ANALYSIS

Objectives

- a) Void volume is decreased which means porosity is also reduced .
- b) Permeability of the soil is reduced.
- c) The bond between the grains are increased then it helps in increasing the mechanical strength.
- d) Strength in shear for the soil is increased significantly.
- e) The properties of the soil particles can be improved in order to construct road.
- f) Stabilization of soil can significantly helps to make a strong base and sub-bases layer.
- g) Consolidation property can be improved

Principles:

- a) Properties of the soil can be determined.
- b) Locking property of the soil particle can be carried out.
- c) Suitable and easy accessible method for stabilization of soil.
- d) For maximum stability and durability the stabilized soil can be designed.

Advantage:

- a) The strength of the clayey soil can be efficiently increased thus it increases the holding capacity of the soil .
- b) Besides deep foundation heavy capacity of the soil can be improved which will be more cheaper and energy saving.
- c) If the strength of the soil is less or in losing stage then stabilization is done in order to do waterproofing the soil which prevents water to seep into soil particles.
- d) In hilly areas it can be used to provide more stability in slope.
- e) With excessive change in temperature it may help in reducing volumetric changes.

7. RESULT AND DISCUSSION

The results are discussed under three categories:

1. Addition of lime to soil.
2. Addition of coir to soil.
3. Addition of lime and coir to soil.

Results of sample is measured with varying percentages of lime and coir. The CBR test results obtained from tests conducted with different proportions of lime & coir are discussed below.

1. The value of CBR test was 18.97%.
2. When 2% of lime of its weight ,the value of CBR for normal soil is increased from 18.97-35.03%.
3. When 4% of coir of its weight the value of the CBR test is increased from 18.97-28.71%.
4. With the addition of 0.5% of coir by weight, the C.B.R. Value increased from 18.97% to 23.35%.
5. With the addition of 1% coir by mass, the C.B.R. Value increased from 18.97% to 37.95%.
6. With the addition of 1% lime and 0.25% of coir by mass, the C.B.R. Value increased from 18.97% to 31.14%.
7. 1% of lime is added and 0.5% is added by weight, the value of CBR test increases.

8. CONCLUSION

The present study has shown following conclusions. From the above discussion it is concluded that

1. With increasing % of coir fibre the strength of the sample increases.
2. When 1% of the coir is added, high value in CBR is observed.
3. CBR values of soil sample increases from 18.97% to 35.03% to highest of 2% of limed, then reduced to 6.32% with the addition of 4% of lime.
4. CBR value go on increasing from 18.97% to 23.35% up to the addition of 0.5% coir, then further increases by 14.6% with the addition of 1% of coir fibre.
5. CBR value goes increasing from 18.97% to 31.14% up to the addition of 0.25% coir and 1% lime, then further decreases by 7.3% with the addition of 0.5% of coir fibre and 1% of limed.
6. From the lab test it can be said that when we use abundant waste like coconut coir fibre it has ability to enhance the engineering behavior of the clayey particle make it worthy in construction work.
7. The CBR values of the clay soil increases twice when lime and coir fibre are mixed.
8. Side effect of the lime is its brittle nature that can be removed with adding fibre which provide ductility.
9. Using lime and coconut fibre it increases the sub grade strength and thus improves pavement life cycle.

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