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SOIL STABILISATION WITH JUTE AND COIR FOR HIGHWAY SUB-GRADE - REVIEW

Uzma Farooq[1], Er. Neeraj Kumar[2]

[1]M. Tech. Scholar SRMIET Kohra Bhura Naraingarh Affiliated to Kurukshetra University
[2]Assistant Professor and HOD of Civil Engineering SRMIET Kohra Bhura Naraingarh Affiliated to Kurukshetra University

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Abstract - *Many soils in natural state at the construction site are very weak as per structural design load. For improvement the soil needs to be stabilized with the help of chemical, mechanical or whatever suitable method as per situation. Stabilization of soil done with the help of waste material is more effective as compared to fresh materials keeping in view the environmental concern. This study shall use jute and coir husk ash as stabilized material for soil. With the use of the above mentioned materials we will find out the positive/negative effects of addition by performing the different concern laboratory experiments.*

Key Words: Soil, improvement, coir, jute, stabilization and environment.

1. INTRODUCTION

The good connectivity to any part of the country in all seasons is the first step to develop the infrastructure of the nation. The structure of road consists of the formation or sub-grade and the pavement. The structural element of the pavement is the foundation (soiling or bottoming) also called the sub grade. The base may be surfaced either with a concrete or a bituminous surfacing. Sub-grade is an integral part of road pavement structure as it provides support to the pavement as the foundation. The main function of the sub-grade is to give adequate support to the pavement and for this the sub-grade should possess sufficient stability under adverse climate and loading conditions. The formation of waves, corrugations, rutting and shoving in black top pavements are generally attributed to poor sub-grade conditions. These are the main reasons why Improvement in sub-grade has always been an area of concern to highway and geotechnical engineers. In case of a highway, a weak sub-grade results in greater thickness of pavement layer which increases the cost of pavement construction. So in order to keep the thickness of pavement under control and cost effective it is better to make the base that is sub-grade (soil) strong enough to bear the load of above layers and traffic.

2. LITERATURE REVIEW

Lot of research work has been done related to the research work I have opted. I explored various research papers which were related to use of various waste materials in sub grade soil. Before the commencement of methodology and various credentials of my research work, following are some researches that were closely related to my work.

1. **Vidhana, et al., (1997) [4]** incorporated coir dust for improving the properties of soil because they are locally available in every state and in most countries, biodegradable and ecofriendly. The tests that were conducted included simply to check the moisture retention capacity of coir in soil and checking enhancement in pore size distribution. Its main research was on sandy soils. The test result indicated the moisture retention of sandy soil progressively increased up to the incorporation ratio of 6.3 % coir dust or 15:1 sand/coir dust (vol/vol) equivalent to 21,000 kg coir dust/ha into sandy soils and there after remained constant upto the incorporation ratio of 20% coir dust (62,000 kg coir dust/ha incorporation into about 10 cm depth) beyond which it increased.

2. **Sivakumar Babu, et al., (2008) [18]** used natural fibre (coir) for improving properties of soil because it is easily available, cheap and ecofriendly. The tests that were conducted included Standard Triaxial test, Consolidation, Shear strength test and Swell test. Test result indicated that deviator stress increased up to 2.5% fibre beyond that it became difficult .Swelling got decreased maximum between 1 to 1.5%.Compressiblity got decreased maximum at 1.5% fibre.

3. **Praveen Aggarwal, et al., (2010) [7]** applied natural fibre (jute) and bitumen for improving properties of soil because jute is easily available and by coating it with bitumen would make it non biodegradable. The test that were conducted included Procter compaction test and CBR test. Test result from proctor test indicated the diameter change did not showed any effect so it was eliminated. It was found at 1% jute fibre MDD was 1.88gm/cc and OMC was 15.5% which was maximum than previous readings. Also at 0.8% jute fibre CBR value increased 3 times as that of soil sample i.e. 5.53%.So overall CBR value of sub-grade soil increased up to 250% with the inclusion of bitumen coated jute fibre.

4. **H. P. Singh, et al., (2013) [10]** applied natural fibre (jute) for improving properties of soil because they are cheap, locally available, biodegradable and eco-friendly. In this study the soil samples were prepared at its maximum dry density corresponding to its optimum moisture content in the CBR mould with and without reinforcement. Tests result indicates that CBR value of

soil increases with the increase in fibre content. It was also observed that increasing the length and diameter of fibre further increases the CBR value of reinforced soil and this increase is substantial at fibre content of 1 % for 90 mm fibre length having diameter 2 mm.. Thus there is significant increase in CBR value of soil reinforced with Jute fibre and this increase in CBR value will substantially reduce the thickness of pavement sub-grade.

5. **Singh, et al., (2014) [12]** made use of coir fibre for improving the properties of soil because they are cheap, locally available, biodegradable and eco-friendly. The test that were conducted included CBR test and UCS test. Test results indicated that both soaked and unsoaked CBR value of soil increases with increase in fibre content. Soaked CBR value increased from 4.75% to 9.22% and unsoaked value increased from 8.72% to13.55% of soil mixed with 1% coir fibre.UCS of soil increased from 2.75kg/cm to 6.33kg/cm upto addition of randomly distributed coir fibre. Adding of coconut fibre results in less thickness of fibre as CBR value has increased.
6. **Hossain, et al., (2015) [19]** made use of natural fibre (jute) and bitumen for improving properties of soil because jute is easily available and by coating it with bitumen would make it non biodegradable. The test that were conducted included Procter Compaction test and CBR test. Test result indicated that inclusion of jute fibre reduces the maximum dry density and increases the optimum moisture content for each length and diameter of jute fibre. Test results for CBR test indicated that CBR value of soil increases with the increase in length of jute fibre. It was also observed that increasing the diameter of jute fibre further increases the CBR value of reinforced soil, and this increase is substantial at fibre content of 1.2% for aspect ratio of 3.75 (length = 30 mm, diameter = 8 mm).
7. **Subramani, et al., (2016) [14]** incorporated natural fibre (coir) for improving properties of soil because they are easily available, cheap and ecofriendly. The tests that were conducted included Consolidation test, Permeability test, Direct Shear test and Unconfined Compression test. Test result indicated that CBR and UCS values of soil-coir Fibre mix increases with increasing percentage of Fibre and maximum improvement in U.C.S. and C.B.R. values are observed when 0.5% of coir is mixed with the soil. Also the strength of soil-coir mix increases with increasing the percentage of coir Fibre.
8. **Bharatidevi, et al., (2019) [16]** had added natural fibre (jute and coir) for improving the properties of soil because both are agricultural waste, cheap and easily available. The tests that were conducted included Atterbergs limit test, Proctor Compaction test, Shear test and UCS test. Test result indicated for Jute maximum OMC and minimum MDD was obtained at 1% of fibre but for Coir it was at 1.5%.For UCS test maximum value for both the fibres was found at 1%.Similar thing happened in case of Shear strength in which maximum value was found at 1% for both the fibres.
9. **Shwetha Prasanna, et al., (2020) [17]** had applied jute fibre for enhancing the properties of soil because they are locally available, biodegradable and ecofriendly. The tests that were conducted included CBR test, modified Compaction test and Atterbergs test. Test result included that, at 0.5% to 1% of jute fibre, increment of MDD and OMC was achieved. but overall, it was concluded that inclusion of jute fibre reduces the MDD and OMC. By comparing the results of direct shear tests it was concluded that angle of internal friction and cohesion is achieved at the range of 1% to 2% of jute fibre. In direct shear strength, cohesion, increase with increasing fibre content until reaching a fibre content of 1%, after which slight decrease in cohesion could be observed because fibre content tends to reduce fibre-reinforcing effects due to the replacement of soil particles by too many fibres By comparing the results of CBR it was observed that maximum improvement in California Bearing Ratio values is observed between 1% to 2% of jute fibre as reinforcement.

These conclusions indicated that jute or coir in suitable contents could enhance the properties of soil. In summary, jute and coir could both have positive effects on sub-grade soil which in turn have proved beneficial for highway pavement.

All my research work will be attributed to above mentioned research works and my work will be in according to these research works.

3. METHODOLOGY

The methodology of research will constitute of following steps:

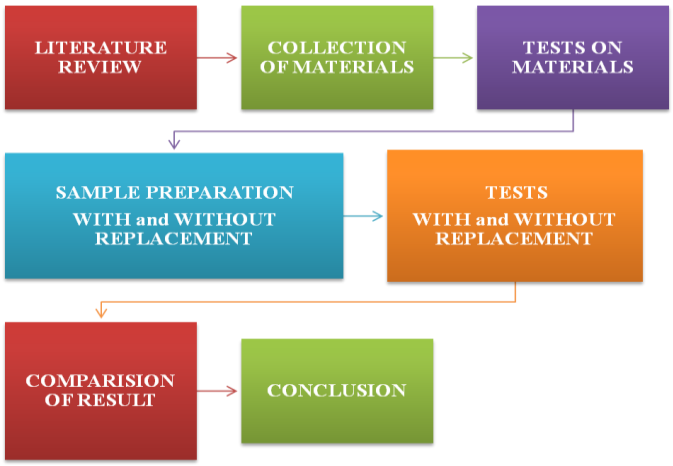

Fig. 1.1 Flow diagram

The objective of present study is a step towards effective use of waste material. As we know India is currently going at a rapid pace toward the development, so is the connectivity increasing and hence are the roads. India is having one of the

largest road networks comprising of urban and rural roads. Since at every place it isn't possible to have firm and strong base (sub grade) for making of pavement for traffic which forms the major part in pavement sustainability so the present research work is aimed at mixing geosynethetic waste material with sub grade soil and analysing the effect on strength, bearing capacity, soil permeability and reducing the environment pollution and promoting the reuse of waste material.

4. MATERIAL TO BE USED

The material to be used for this research works are:

a) Soil

Soil is biogeochemical dynamics natural resource that supports all critical components that comprise terrestrial ecosystems. It has been called earth's living skin. The main component on which research work is to be done is the soil which in our research would be locally available soil.

b) JUTE

Jute is a natural fibre popularly known as the golden fibre. It is one of the cheapest and the strongest of all natural fibre and considered as fibre of the future. Jute is second only to cotton in world's production of textile. India, Bangladesh, China and Thailand are the leading producers of the jute.

c) COIR FIBRE

Coir, Coconut fibre is a natural fibre extracted from the husk of coconut and used in products such as floor mats, doormats, brushes and mattresses. Coir is the fibrous material found between the hard, internal shell and the outer coat of a coconut. In this research work coir husk will burn into ash and added to the soil

5. OBJECTIVE OF STUDY

The objective of present study is a step towards effective use of waste material. The major objectives of the work are:

- To compare the virgin soil and modified soil for the properties of sub-grade soil.
- To safer utilisation of waste material that is jute and coir.
- To find out the optimum percentage of use of waste material that is jute and coir by conduction of concerned tests on virgin and stabilise soil sample for highway sub-grade.
- To provide a strengthen embankment for highway sub-grade for safer transformation of loads.
- To modify the soil for highway subgrade at economical cost.

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