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Recital of Resistant Coir Fibre in Stony Sub-Base Placed on Unreserved Soil Sub-Grade

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Abstract

Research into new and innovative uses of waste materials is continually advancing. Many highway agencies, private organizations, and individuals are in the process of a wide variety of studies and research projects concerning the feasibility, environmental suitability and performance of using recycled products in highway construction. It is necessary to utilize the wastes effectively with technical development in each field.

Reinforcement of fly Ash with synthetic fibers is potentially an effective Technique for increasing fly ash strength. In recent years, this technique has been suggested for a variety of technical applications ranging from retaining structures and earth embankments to sub-grade stabilization beneath footings and pavements. Several investigators have conducted research on different types of reinforcement and materials. However, the amount of information available on randomly oriented fiber reinforcement is still limited. Here an attempt is made to the suitability of different types of natural fibers reinforcing in fly ash with different percentages. By using this (i.e., fly ash) waste material effectively with reinforcing another waste material is a good idea for better cost-effectiveness and proper utilization.

The Gravel is a good material in flexible pavement construction of sub-base layer, but because of the shortage of high gravel quality; and the presence of high fines, it increases construction costs in certain regions of the country.

Due to under these circumstances, we are utilizing coir, sisal and jute fiber materials are used as reinforcement material in the poor gravel and fly ash sub base courses laid with respect to expansive soil subgrade finally to reduce the expense of road construction, improve elasticity Nature. It was observed from the laboratory experimental data of modified compaction, Box shear, and California bearing ratio that the optimum level of coir, sisal and jute fiber is equal to 0.2% for Gravel, fly ash material.

By using this (i.e., fly ash), waste material effectively with reinforcing another waste material is a good idea for better cost-effectiveness and proper utilization in sub-bases to reduce the designed thickness of pavement layers and cost also.

***Keywords**: - Fly ash, Coir fibre, Working methodology, Road construction.*

INTRODUCTION

Generally, in the construction of a highway network, a large number of standard pavement materials in sub-base layer like gravel, sand and morrum etc., are necessary. In current circumstances, the above materials are not sufficiently accessible because their quantities gradually decline and the price of collecting natural product of good quality is increasing conventionally, all types of roads in our country were constructed using gravel, and it is effectively used in highway development for sub-base and base courses. Gravel is a good material in flexible pavement construction because of the shortage of high gravel quality; it increases construction costs in certain regions of the country. In the flexible pavement sub-base layer, gravel material is a standard material, but due to high fine particles presence, the plasticity is increasing, so it is affected to construction expenses. At this point, it is satisfied by utilizing Geo-Textile materials (Coir, sisal, jute fibers) as strengthened materials to improve sub-base conditions and to diminish costs of Pavement construction.

ADVANTAGES OF USING FLASH FOR ROAD CONSTRUCTION

Fly ash is a lightweight material, as compared to commonly used fill material (local fly Ashe), therefore, it causes lesser settlements. It is especially

attractive for embankment construction over weak subgrade such as alluvial clay or silt where excessive weight could cause failure.

Fly ash embankments can be compacted over a wide range of moisture content, and therefore, results in less variation in density with changes in moisture content. Easy to handle and compact because the material is light, and there are no large lumps to be broken down. It can be compacted using either vibratory or static rollers.

- High permeability ensures free and efficient drainage. After rainfall, water gets drained out freely, ensuring better stickability than fly ash. Work on fly ash fills/ embankments can be restarted within a few hours after rainfall, while in the case of fly ash, it requires a much longer period.

- Considerable low accessibility results in negligible subsequent settlement within the fill.

- It conserves good earth, which is precious top fly ash, thereby protecting the environment.

- A higher value of California Bearing Ratio as compared to fly ash provides for a more efficient design of road pavement.

- Pozzolanic hardening property imparts additional strength to the road pavements/embankments and decreases the post-construction horizontal pressure on retaining walls.

- Can replace a part of cement and sand in concrete pavements, thus making them more economical than roads constructed using conventional materials.

- Fly ash admixed concrete can be prepared with zero slumps making it amenable for use as roller compacted concrete.

Considering all these advantages, it is extremely essential to promote the use of fly ash for the construction of roads and embankments. In view of the above, an attempt is made in this study to utilize flash in the flexible pavement sub base system as a substitute material in place of the fly ash sub base.

A variety of geosynthetic materials had already been commonly used as reinforcement materials to provide

greater stability for granular sub-base and base layers. Geo-textile materials are very cheap and price-effective. Material availability is more and utility purpose is efficiently in various engineering applications.

Ramakrishna 1996 has investigated on coir fibers are produced from natural fibers are used to prevent erosion but not to strengthen the soil. Strong fibers such as coil having a very high amount of lignin can be used as a strengthening material if they are treated appropriately. A literature review suggests that coir having excellent potential fiber material as a soil reinforcement substance Rao G.V. and Balan K. (1997). Geosynthetics material are flexible, and its permanent reinforced material in base or sub-bases is widely used as sub-grade reinforcement inflexible or rigid pavement built over soft sub-grade to help support unpaved base or sub-base loads during its construction is studied by Geo-synthetic Materials Association (2000).

Ramanatha Ayyar et al. (2002) illustrated that the natural fibers (coir) are very rigid in nature and highly sustained materials, their cost is very less and availability is very more in India and the other Asian countries where coconut trees are grown. Axel Nernheim (2005) discussed how geosynthetic enhanced structures interact with the soil and geosynthetic materials. But some of these products are non-biodegradable and often result in waste disposal and pollution. Siva Kumar Babu G.L et al. (2008) suggested Coir is random reinforcing material with black cotton soil which can result to improve engineering solutions fly ash utilization is more in geotechnical construction structures like road sub-bases, filling and replacement etc. to solve many problems in the field used as a construction material. The use of fly ash is widely acknowledged as filling materials for reconstruction or road construction for the sub-base system.

(Reddy et al. 1999) or base courses (Tike et al., 1999). (Kumar & Sharma 2004), Praveen Kumar and Pratap Singh (2007) have studied in case of geosynthetic strengthened fly ash, all geosynthetic utilized in their research are appropriate for road sub-bases laid on poorly graded exceptional sand. Reinforcing the soil with short fiber appears to have incredible potential for utility inroads when alternate materials are also used.

Roy (2010) suggested improved use of jute-geo-textile in the compacted granular sub-base course in CBR is

compared to the Sub-base with no jute geotextile.

Venkateshwara Rao et al. (2014) observed the use of reinforced coir fiber in gravel sub-bases together execution concerning CBR would continue up to 0.2 % beyond that it doesn't influence and the expansion of coir incorporation in soil brought about an obvious increment in the shear qualities and CBR esteems. Sand-fiber composite joined with 25 % of affixed using the heaviness of sand. It might coordinate high caliber as sub-base texture having CBR more than 20 %. (Joyanta Maity et al., 2017).

In the perspective of this, the possible application of the geotextile materials such as coconut coir, sisal and jute for granular sub-base layer in the flexible pavement with gravel and fly ash can be studied to assess its utility as better resource materials.

METHODOLOGY

Objectives

- To reduce the thickness of sub-base layer by using natural fiber.
- To avoid scarcity of sub-base material.
- To reduce the construction cost of roads.

WORKING METHODOLOGY

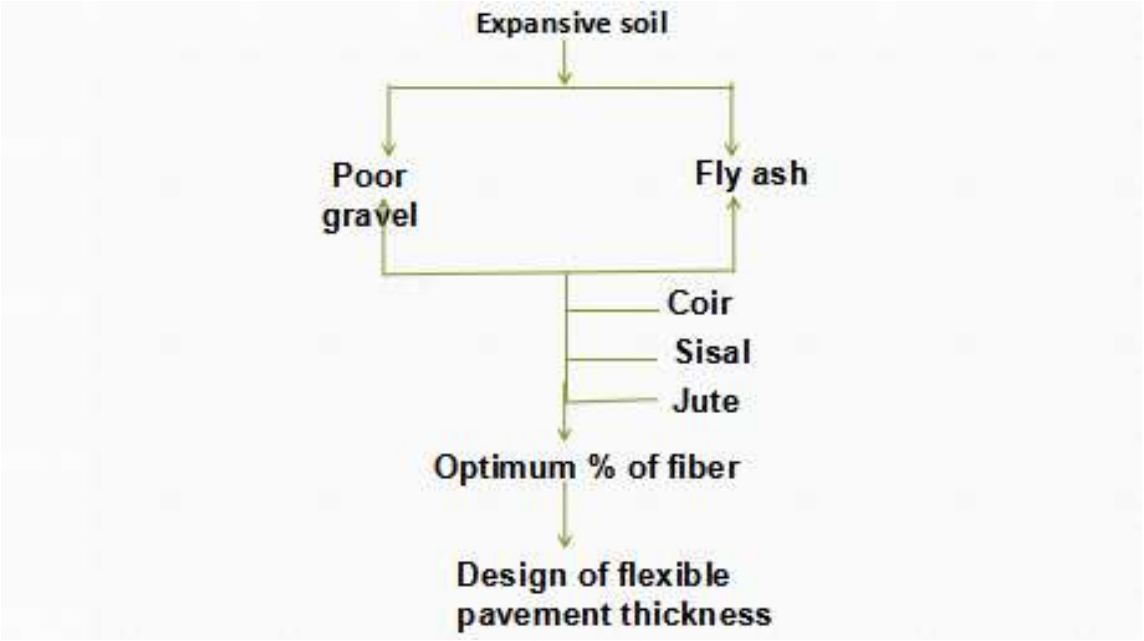


Figure 1

RESULTS

A	B	C	D	E	F	G	H	I	J
combination	load	pressure	cbr(%)	1.75P	3.14*pressure	(1.75P/CBR)	P/3.14*pressure	G-H	Thickness of pavement= SQUARE ROOT OF (G-H)
B.C. SOIL	1370	69.77	2	2397.5	219.0778	1198.75	6.253486204	1192.497	34.53254282
GRAVEL	1370	69.77	6.13	2397.5	219.0778	391.109299	6.253486204	384.8558	19.61774228
GRAVEL + Coir	1370	69.77	7.6	2397.5	219.0778	315.460526	6.253486204	309.207	17.5842839
Fly Ash	1370	69.77	6.1	2397.5	219.0778	393.032787	6.253486204	386.7793	19.66670538
Fly Ash +Sisal fiber	1370	69.77	7.92	2397.5	219.0778	302.714646	6.253486204	296.4612	17.21804752
Fly Ash +Jute fiber	1370	69.77	11.06	2397.5	219.0778	216.772152	6.253486204	210.5187	14.50926138
GRAVEL +Jute fiber	1370	69.77	10.06	2397.5	219.0778	238.32008	6.253486204	232.0666	15.23373209
GRAVEL + Sisal fiber	1370	69.77	7.3	2397.5	219.0778	328.424658	6.253486204	322.1712	17.94912731
Fly Ash + Coir	1370	69.77	8.5	2397.5	219.0778	282.058824	6.253486204	275.8053	16.60738803
Stone Dust	1370	69.77	14	2397.5	219.0778	171.25	6.253486204	164.9965	12.84509688

Figure 2

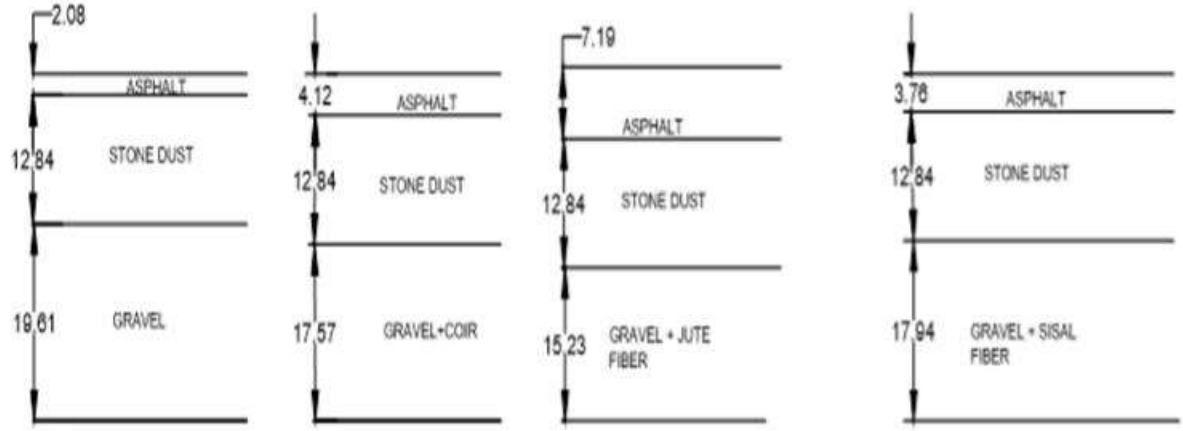


Figure 3: Thickness Reduction of Gravel with Different Fibers Combination

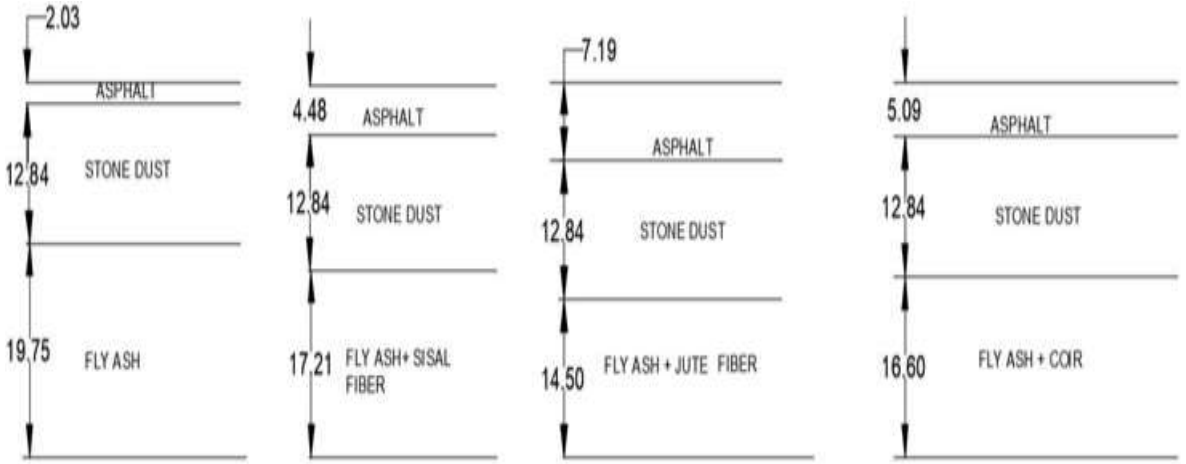
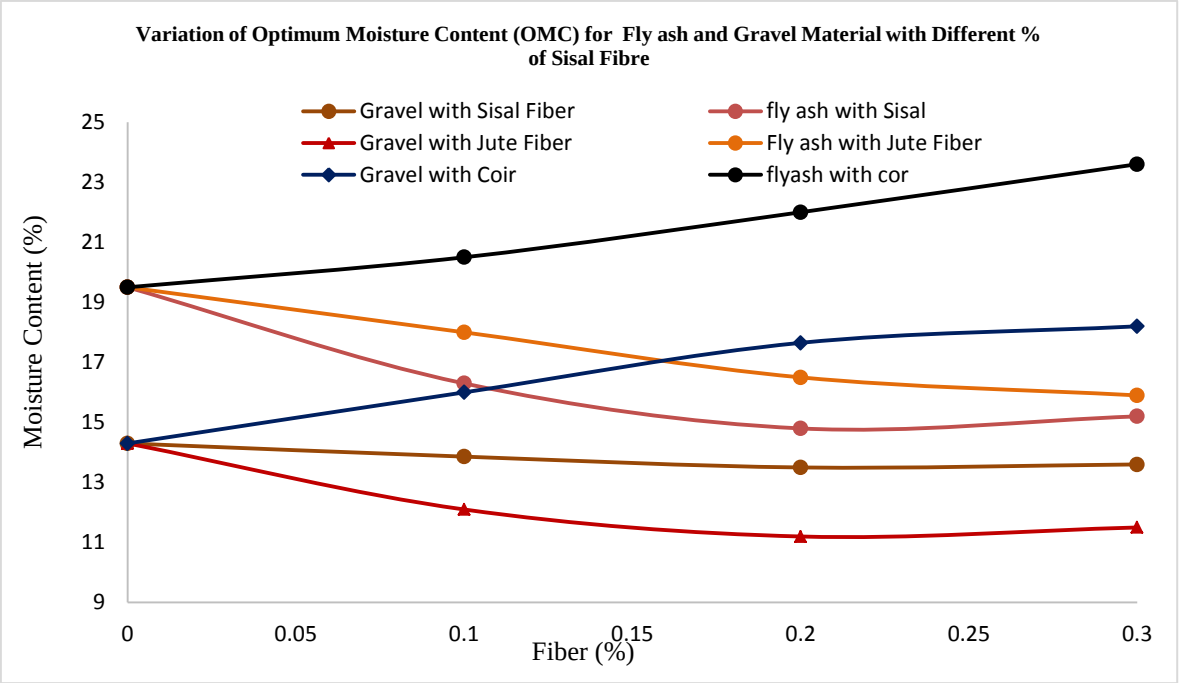
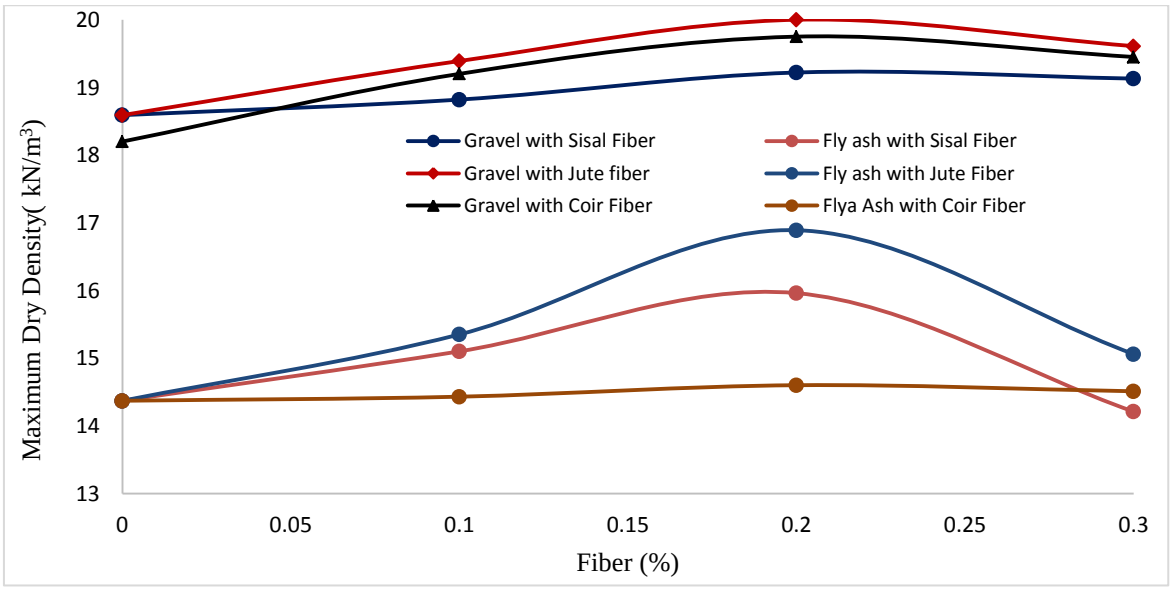


Figure 4: Thickness Reduction of Fly Ash with Different Fibers Combination

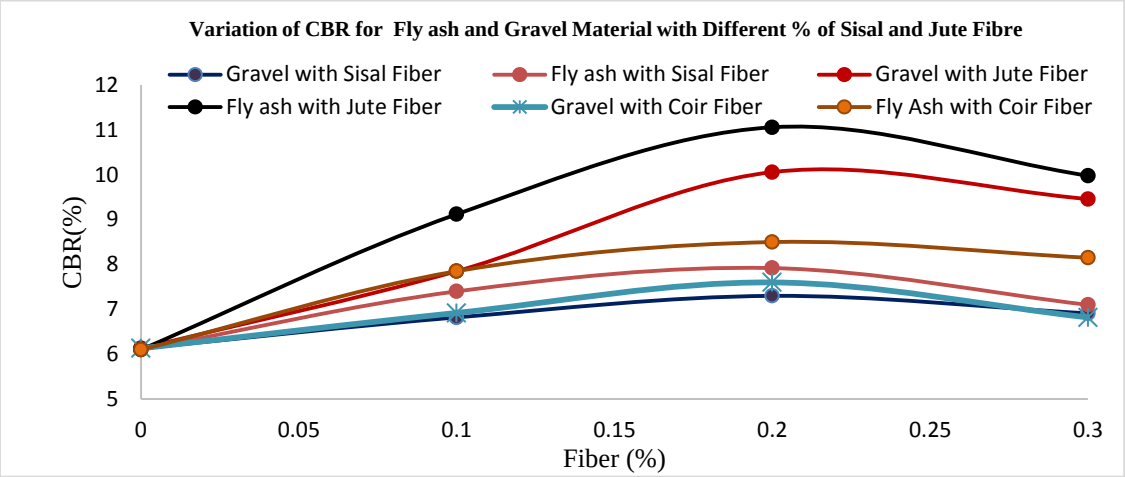
Laboratory Experimentations Results



(a) Effect of OMC for Fly Ash and Gravel Material with Different % of Sisal and Jute



(b) Effect Of MDD for Fly Ash and Gravel Material with Different % of Sisal and Jute Fibers



(c) Effect of CBR For Fly Ash and Gravel Material with Different % of Sisal and Jute Fibers

In the above figures, we observed the fly ash with sisal, jute fiber, the soaked strength category of CBR values improved range of 6.13 to 7.6% of coir, 6.13 to 7.3% of sisal, 6.13 to 10.06% of Jute similarly 6.1 to 8.5% of sisal fiber, 6.1to 7.92% of Sisal and 6.1 to 11.06% of jute fiber up to 0.2 % after that the sisal and jute fiber it cannot resist CBR parameters. Compaction, Shear parameters and CBR Experimental results show the optimum percentage for Gravel and fly ash with different materials is 0.2%. It is observed from the test results that Gravel and fly ash with coir, sisal and jute fiber have shown effective behaviour when compared to unreinforced fly ash material.

CONCLUSIONS

1. The Gravel and fly ash reinforced with the various Coir percentages, sisal and jute fiber performs a 0.2 % optimum level of sisal and jute reinforcement.

2. The addition of sisal and jute material of more than 0.2% does not influence Strength Parameters such as Compaction, Shear parameters and CBR.

3. The accumulation of Coir, sisal and jute with fly ash results in a significant increase in the CBR values.

4. Particularly, jute geo-material conduct shows better execution in sub-bases.

5. Finally, thickness reduction of flexible pavement thickness material of fly ash is better than Gravel material used in sub-bases.

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