STUDY ON USE OF VARIOUS WASTE MATERIALS IN ROAD CONSTRUCTION

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Abstract - *The fundamental target of the current examination is to survey the value of farming and modern waste as a dirt admixture, and centered to improve the building properties of soil to make it fit for lower layer of street development. Present examination portrays the conduct part of soils blended in with modern waste materials viz. fly debris (FA), rice husk debris (RHA) and bagasse debris (BA) and rural waste material to improve the heap bearing limit of the dirt. Clayey soil has been viewed as utilizing four distinct kinds of stabilizer viz. FA, BA, RHA running from 5 to 35% by weight of soil. The physical and concoction properties of these stabilizers were determined and looked at. Admixing of every one of these stabilizers improve drenched CBR esteems significantly and sensational decrease in dry thickness was watched.*

In present scenario safe disposal of Industrial wastes is a great problem. These waste materials create environmental pollution in the vicinity because many of them are non-biodegradable. Studies reveal that in recent years, industrial wastes were successfully used in road construction in many developed countries. The use of these materials in road making is based on technical, economic, and ecological criteria. India has a vast network of industries located in different parts of the country and many more are to come in the near future. Million metric tons industrial wastes are produced in these Industries. The pollution and disposal problems may be minimized by properly utilizing these materials in highway construction. It is important to test these materials and to develop a methodology and specifications to enhance the use of these industrial wastes for their effective utilization in road construction in India. The probable use of these materials should be developed for construction of low-volume roads in different parts of our country. A review of various Industrial wastes to be used in the construction of highway has been discussed in this paper. The common waste materials are fly ash, blast furnace slag, cement kiln dust, phosphogypsum, waste plastic bags, foundry sand and colliery sand.

Key Words*: *Agricultural Waste; Industrial Waste; Baggasse; Fly Ash; Rice Husk Ash, Sandy soil.

1. INTRODUCTION

India creates a huge measure of various sorts of waste materials as results from various parts like mechanical, horticultural, and so forth. These waste materials if not kept securely it might be unsafe. The sum and kind of waste created increments with increment in populace. These squanders stay in nature for longer term since it is unused. The garbage removal emergency emerged because of the making of non rotting waste materials. One answer for this emergency lies in reusing waste into valuable items. Examination into new and inventive employments of waste materials is constantly progressing. In India, research is in progress to inspect the potential for utilization of some locally accessible squanders in street development.

Indian coals, however low in sulfur, contain higher measure of debris (around 35-45%), bringing about colossal amounts of fly debris in India. The yearly age of fly debris has expanded as appeared in figure 1 (Kumar V. et. al., 2005). Fly debris can give a sufficient cluster of divalent and trivalent cations (Ca +, Al +, Fe +, and so forth.) under ionized conditions that can advance flocculation of scattered earth particles. Consequently, far reaching soils can be conceivably settled by cation trade utilizing fly debris (Kumar, A. et al. 2007).

Rice husk is tremendous accessible in rice creating nations like China, India, Indonesia, Bangladesh, Brazil and South East Asia. Rice husk is predominantly utilized as a fuel in businesses in boilers for measure vitality necessities and for power ages. Rice husk is a fuel having high debris content, changing from 20-25% of rice husk and substance having 80-90% of silica. In most of rice creating nations a significant part of the husk delivered from the preparing of rice is either scorched for heat or dumped as a waste. India alone creates around 120 million tons of rice paddies every year, giving around 24 million tons of rice husk and 4.4 million tons of RHA consistently (Govindarao, 1980). Rice is a staple food in the diet for much of the world. Production of rice was 696.32 MMT in the world and India stands second largest in the production with 142 MMT (FAOSTAT). The quantity of agricultural residues produced differs from crop to crop and is affected by seasons, soil types, and irrigation conditions. Indian clayey soils can be problematic for direct utilization of subgrade construction. Clayey soil applies to soils that have the tendency to swell when their moisture content is increased. Soils containing the clay mineral montmorillonite generally exhibit these properties. The clayey soils have a low bearing capacity in the presence of water and more shrinkage cracking in dry condition. Admixing some percentage of cement or cementitious material with soil improves the bearing capacity but crack formation due to shrinkage cannot be minimized. Hence, highway engineers are putting constant efforts in finding material which are really potential to improving the bearing capacity as well as for shrinkage cracking control. In the present study, an effort has been made in the similar direction, by selecting RHA as an admixture to improve the strength properties of selected clayey soil.

2. MATERIALS

(a).Wasted Sandy Soil: Clay of medium compressibility (A-7-6) soil is used for this study. The index properties such as liquid limit, plastic limit, plasticity index and other important soil properties as per AASHTO and United States soil classification systems are presented in Fig . presents the grain size distribution curves of the soil.

We present the results of a plot experiment in which the changes in physical, chemical and physico-chemical properties of a sandy soil were examined after amending the soil with two different composts produced from municipal solid wastes. Triticale (X *Triticosecale*), cultivated in a 3-y monoculture, was used as a test plant. Both composts differed in their concentrations of heavy metals. Composts were applied non-recurrently in the spring before sowing, at the rates of 18, 36, and 72 t dry matter ha^{-1}. The plots without fertilization, and those fertilized annually with mineral nitrogen (N), phosphorous (P), and potassium (K) were used as controls. Soil samples were collected 1 month after compost application, as well as each year after harvesting. Application of both composts improved soil physical properties, associated with increasing content of organic carbon (OC). Statistically significant increases of total porosity, field water capacity and amounts of plant-available water were found only in the short time after compost application. Despite the fact that soil OC content decreased with time, a C:N ratio clearly increased in the third year after compost application, which was explained by a depletion of N reserve. Both composts caused a large increase of plant-available P, K, and magnesium (Mg), which was observed during the entire period of the experiment.

(b).Fly Ash: The fly ash used in the study was brought from National Thermal Power Station situated at Ghaziabad which was available free of cost. Fly ash is classified as silts of low compressibility (ML). The chemical, physical and engineering properties of ash depends on the type and source of coal used, method and degree of coal preparation, cleaning and pulverization, type and operation of power generation unit, ash collection, handling and storage methods etc. So the properties of fly ash vary from plant to plant and even within the same plant. The physical and chemical properties of fly ash tested in laboratory are given in Table

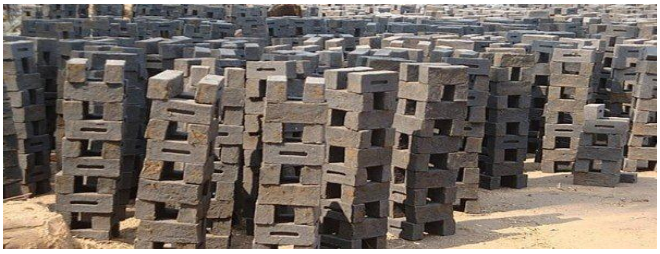
Table-1-Engineering properties of Fly ash

Parameter	Range
Specific Gravity	1.90 – 2.55
Plasticity	Non plastic
Maximum dry density (gm/cc)	0.9 – 1.6
Optimum moisture content (%)	38.0 – 18.0
Cohesion (KN/m2) Negligible Angle of internal friction (¢)	300 – 400
Coefficient of consolidation Cv (cm2/sec)	1.75 x 10-5 – 2.01 x 10-3
Compression index Cc	0.05 – 0.4
Permeability (cm/sec)	8 x 10-6 – 7 x 10-4

(c). Bagasse Ash (BA): The bagasse ash used in the study was brought from Sugar Mil. The ash was obtained from this mill at a boiler temperature of 750-800°C. The bagasse ash produced at the plant was about 2-2.5 % of the bagasse used in boiler.

S.No.	Country	Annual ash production, MT	Ash utilization %
1	India	112	38
2	China	100	45
3	USA	75	65
4	Germany	40	85
5	UK	15	50
6	Australia	10	85
7	Canada	6	75
8	France	3	85
9	Italy	2	100

(d). Rice husk ash: Rice husks or rice hulls or are the hard protecting coverings of grains of rice. In addition to conservation rice during growing season, it is used as building material, fertilizer etc. RHA (Rice Husk Ash) contains amorphous silica. Husk generated during milling is mostly used as a fuel in the paddy boilers. About 20 million tons of RHA (Rice Husk Ash) is produced annually. This material cause's environment ultimatum, when this material is disposed it causes damage to the land, environment and surrounding area.



Rice Husk Bricks

(e). Charcoal:

Charcoal is a lightweight black carbon residue produced by strongly heating wood (or other animal and plant materials) so as to drive off all water and other volatile constituents. In the traditional version of this pyrolysis process, called charcoal burning, the heat is supplied by burning part of the starting material itself, with a limited supply of oxygen. Charcoal can also be produced by heating the material in a closed retort.

This process also happens while burning wood, as in a fireplace or wood stove. The visible flame in that case is actually due to combustion of the volatiles given off as the wood turns into charcoal. The soot and smoke commonly given off by wood fire result from incomplete combustion of those volatiles. Charcoal itself burns at a higher temperature than wood, with hardly a visible flame, and gives off practically no smoke, soot, or un burnt volatiles.

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3. OBJECTIVE OF THE STUDY

• In creating nations like India. Transportation is most significant prerequisite for monetary and social turn of events. The utilization of these materials in roadway/street making depends on specialized, monetary, and natural standards. The contamination and removal issues can be halfway decreased

• In consistently a few million metric tons mechanical squanders are delivered in these foundations. In a similar time, the economical advancement idea requires a more proficient administration of waste materials and safeguarding of condition

• To change the geotechnical properties of soil by utilizing scrap tires as a stabilizer.

• The lab tests led, to assess their properties.

• Analysis and understanding of result.

4. RESULT AND DISCUSSION

The drenched CBR estimation of the soil increments with the expansion of FA and BA up to a 25 % of FA and RHA and from that point these qualities begin diminishing (Figs.5 and 6). The pattern of increment of CBR esteems with the rate substance of FA is around direct upto 20% admixing. Sudden increment in CBR esteems were likewise seen between 20% and 25 % FA admixing. Additionally it was discovered that the CBR expanded from 7.8 to 8.5% with the relieving time frame from 3 to 28 days at 25% of FA admixed with soil. In the event of BA, CBR improves continuously upto 25% after this diminishing with further expansion of BA. This conduct was more articulated for FA-soil in contrast with BA-soil. These patterns obviously delineated that FA is more compelling somewhere in the range of 20 and 25% admixing. At 25% of BA content, the CBR expanded from 6.4 to 7.8% with the relieving time frame from 3 to 28 days. While, RHA admixing improves the CBR esteems considerably upto 25% substitution level (Fig.7). The pattern of increment of CBR esteems were progressive and more predictable in contrast with that of FA admixed soil tests. The drenched CBR esteems acquired while admixing RHA were a lot higher than that of FA and BA admixing. The rate increment of CBR esteem were more for higher rate RHA admixed soil tests concerning FA and BA admixed soil tests. The expansion in relieving period from 3 to 28 days expanded the CBR from 11.15 to 13% at 25% of RHA content. The expansion of drenched CBR esteem for RSA admixed soil test indicated straight relationship with the debris content up to 20% after which this expansion is loosened with increment of RHA. The CBR estimation of soil admixed with 20% RSA were a lot higher than that of 25% FA, 25% BA and 25% RHA admixing. The constructive outcome of restoring period from 3 to 28 days was watched for RSA admixed with soil at 20% RSA content, which expanded the CBR from 11.87 to 17.74% individually. The low CBR of the clayey soil (when contrasted with clayey soil-stabilizers blends) is credited to its intrinsic low quality which is because of the strength of the mud division. In general, the improvement saw on doused CBR esteems on admixing of stabilizers were because of the frictional opposition contributed from the FA, BA, RHA.

5. CONCLUSION

In the current examination execution of different agrarian and modern waste materials in street development are concentrated through research facility examination. The dirt admixed with FA, BA, RHA and RSA tests were restored as long as 28 days before testing. Different tests like shrinkage limit, CBR, UCS, and triaxial test were directed. The accompanying ends have been drawn from these research center tests:

Checked upgrades in shrinkage limits were watched for soil admixed with FA, BA, RHA and RSA. This improvement was more articulated for 30% RHA admixing.

Admixing of FA, BA, RHA and RSA made to have higher ideal dampness content as the measurements of stabilizers expanded. This expansion was more articulated for RHA admixed soil-blends in contrast with that of different stabilizers. Be that as it may, dry densities were diminishing with expanding in the level of FA, BA, RHA and RSA. This decrement was more articulated for RHA to that of different stabilizers.

Admixing of FA, BA and RHA upto 25% and RSA upto 20% expanded CBR estimations of clayey soil at all restoring days. The CBR estimation of soil admixed with 20% RSA were a lot higher than that of 25% FA, 25% BA and 25% RHA admixing. The beneficial outcome of relieving period from 3 to 28 days was watched for RSA admixed with soil at 20% RSA content, which expanded the CBR from 11.87 to 17.74%.

In light of the current investigation, all stabilizers viz. FA, BA, RHA and RSA achieves its ideal quality following 28 days relieving period. It is proposed that these can be used as a successful soil stabilizer if accessible in bountiful amount. The outcomes depend just on research center examinations and subsequently it is additionally suggested that the feasibility and long haul execution in field, of this material ought to be resolved in genuine roadway development ventures.

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