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"EFFECT OF RICE HUSK ASH AND WASTE PAPER SLUDGE ON THE STABILIZATION OF SOIL IN ROAD CONSTRUCTION

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ABSTRACT: The top layer of earth known as soil consists of mixture of organic and inorganic particles and does not have greater strength to bear the load. India is a fast-growing nation and construction activities are increased day by day which results in scarcity of land, in order to overcome this problem, we have to improve the properties of soil by using stabilization techniques. In the modern world stabilization of soil becomes important before construction of any engineering project such as building construction, bridges, railways, airports. In order to make the stabilization process economical, the industrial wastes are used to replace the costly stabilizers. This research consists of materials such as RHA and WPS which are the wastes produced from rice husk mill and paper industry. RHA is added to natural soil in different percentages (4%, 8%, 12%, 16%). The optimum percentage of RHA to the soil found to be 8%. The UCS values of natural soil increases from 78.01kN/m2 to 116 kN/m2. After that the WPS is added to soil + 8% RHA mix at different percentages of WPS (2.5, 5, 7.5, and 10) %. It was found that optimum value of UCS was found at 5% WPS and UCS value obtained at this percentage is 223.01 KN/m2.

Keywords: Rice Husk Ash, Waste paper sludge, maximum dry density, unconfined compressive strength

I. INTRODUCTION

The big challenge in civil Engineering comes in play when we lay roads, built structures, railway lines etc. in the soil which have not enough capacity to with stand the load of these structures. In order to overcome this problem, we have to stabilize the soil before building any civil engineering structure. Different techniques are used to stabilize the soil to increase its load carrying capacity. The process of adding stabilizer to soil is called stabilization. The stabilizing agents such as lime, cement etc. are used to stabilize the soil, but this type of stabilization involve large cost. In order to overcome this problem, we use new type of materials which are not so costly but possess good pozzolanic properties such as Pond ash, Rice husk ash, Fly ash, Silica fume and waste paper sludge. They are the by-products of different materials having

good pozzolanic properties which are helpful to bind the soil particles to increase its load carrying capacity. This study involves the combined effect of RHA and WPS on the properties of soil.

II. LITERATURE REVIEW

APARNA ROY (2014) studied the effect of RHA along with little quantity of cement on the stabilization of soil process. The RHA is collected from Bhishal Lakshmi mills at Brudwn. The small percentage of cement with RHA increase optimum moisture content and decreases MDD of clay soil. The UCS value is increased of about 90.6% at 10% RHA. The maximum improvement occurred when soil is treated with 6% cement and 10% RHA. The improvement in CBR for unsoaked sample is about (106% at 10% RHA content), when compared with CBR of virgin soil.

CHANDRA et al (2015) studied the effect of the non-expensive clay soil with addition of RHA and lime sludge. The percentage of RHA to soil from 5% to 20% with an increment of 5. The lime added to soil from 4% to 16% with a gap of 4%. The properties of soil revealed when different percentages of RHA and lime is added, and determined the properties of soil such as Atterberg's limit, CBR value, MDD and UCS.

DILIP KUMAR TALUDKAR (2015) stated the consequence of WPS sludge on different clayey soils. The study involves the compaction, Atterberg's limits and swelling properties of soil. The soil properties of soil are analyzed when WPS is added to the soil at different percentages (0, 5, 10, 15 and 20%). The result shows the decrease in plasticity index, maximum dry density and increase in optimum moisture content. The CBR value of soil samples increases at 15% of WPS

NEVA ELIAS (2015) calculated the outcome of WPS on strength of soft soils by conducting different tests such as UCS, compaction. Before discharge, the sludge should be dewatered. The sludge should be acquired from Hindustan news print, Vellore Kottayam. Different percentages of WPS are added to the soil sample (2, 4, 6, 8, 10 and 12%). As a result, the dry density and water the water content increases and decreases respectively. The result shows the optimum moisture content for maximum percentage increase is 22.7%. The maximum dry density attains constant value of 12.9 at 20% to 25% of WPS, also compressive strength increases from 314KN/m2 to 496KN/m2 for 7 days curing and 284KN/m2 to 590KN/m2 for 28 days of curing period.

III. MATERIALS USED

A. SOIL

The soil taken for this project or investigation was chosen locally. Before taking the soil sample the top layer of soil was removed and we go deep from that point to 1.5 meter below to get the sample for research work. The properties of soil are as under:

S. No	Properties	Confirming to IS Code	Value
1	Natural Water Content	IS:2720 (Part 2)-1973	11
2	Specific Gravity	IS:2720 (Part 3)-1980	2.44
3	LL%	IS:2720 (Part 5)-1985	23.338
4	PL%	IS:2720 (Part 5)-1985	13.86
5	PI%	IS:2720 (Part 5)-1985	9.478
7	Maximum Dry Density (g/cc)-Standard Proctor Compaction	IS:2720 (Part 8)-1983	1.912
8	OMC (%)	IS:2720 (Part 7)-1983	12
9	UCS (kg/m^2)	IS:2720 (Part 10)-1991	78.01

Tab. 3.1 Properties of Natural Soil

B. Rice Husk Ash

RHA is ordered from India mart and dried in an open atmosphere and passed through 90mm sieve. The specific gravity of rice husk ash was found to be 2.15.

Chemical composition	Percentage (%)
Silicon Dioxide	88.32
Alumina Oxide	0.46
Ferrous Oxide	0.67
Calcium Oxide	0.68
Magnesium Oxide	0.44
Sodium carbonate	0.12

Tab. 3.2 Chemical Composition of RHA

3. Waste Paper Sludge

Chemical composition	Percentage (%)
Silicon Dioxide	3.48
Alumina Oxide	2.36
Ferrous Oxide	0.52
Calcium Oxide	58.21
Magnesium Oxide	0.64
C- O (Organic)	34.8

Tab. 3.3 Chemical Composition of WSP

IV. METHODOLOGY

The study work is performed in two phases. In the first phase Normal Soil and rice husk ash are mixed in different proportions. The distinct mixes are examined for MDD and OMC by Proctor test. After obtaining the MDD and OMC, the strength of each mix is determined by conducting the UCS test. In the second phase of the study work, waste paper sludge is added to the optimum mix of (Normal Soil and RHA mix) obtained in first phase. The distinct mixes are analyzed for MDD and OMC by Proctor test. After getting the values of MDD and OMC, the strength of each of the mix is determined by conducting UCS test.

V. RESULTS AND DISCUSSIONS

A. STANDARD PROCTOR TEST

Standard Proctor compaction test was done based on IS 2720-part VII, varying percentage of RHA were added to the parent soil and mixed thoroughly. In the below table and graph drawn b/w different RHA percentages and MDD and different WSP percentages and MDD the results are below:

RHA	OMC	MDD
0	12	1.971
4	18	1.78
8	20	1.698
12	24	1.589
16	26	1.460

Tab.5.1 Observations of OMC and MDD values of soil with the admixture RHA by various percentages

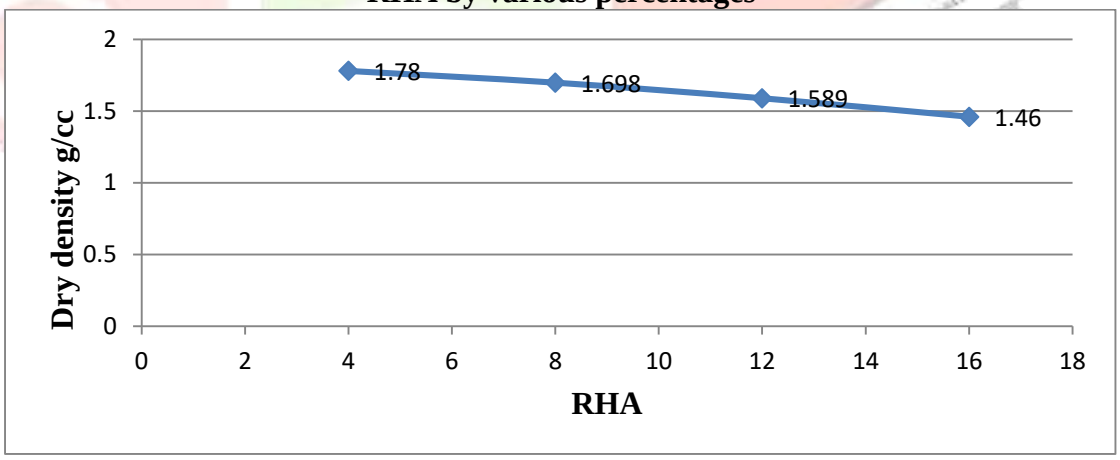

Fig.5.1 MDD vs RHA%

WPS	OMC	MDD
0	12	1.971
2.5	20	1.796
5	20	1.987
7.5	20	1.656
10	20	1.54

Tab.5.2 Observations of OMC and MDD values of Soil-RHA Mix with various proportions of WSP

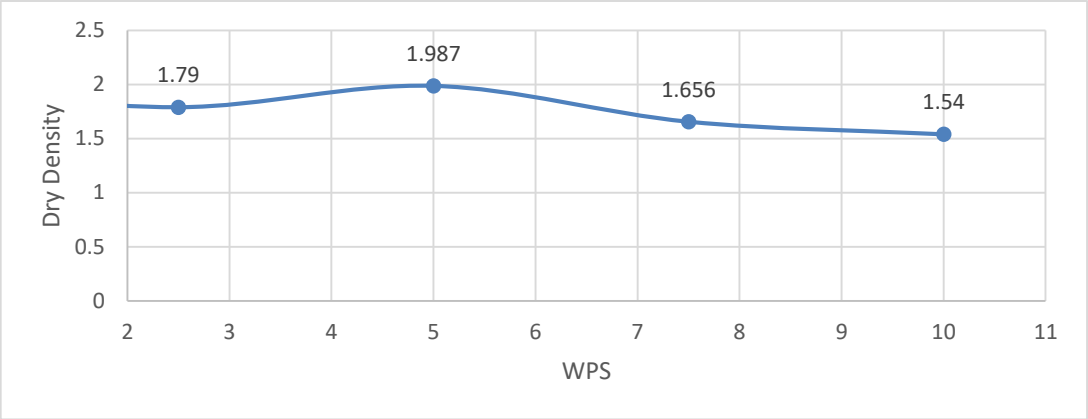

Fig.5.2 MDD vs WPS%

B. UNCONFINED COMPRESSION TEST

The unconfined compression test was conducted according to IS 2720-part X. It is used to determine the compression strength of the soil. Also, we analyze the change in properties of soil with addition of RHA and Waste paper sludge in the soil sample in different proportions. The unconfined compressive strength of parent soil was 78.01 and by the addition of RHA it is increased upto 116.76 at optimum value of 8% RHA and by addition of WSP the unconfined compressive strength of soil increases upto 223.01 at optimum value of 5% WSP.

Serial No.	RHA%	UCS of Soil in (KN/M^2)
1	Un-Treated	**78.01**
2	4%	**102.02**
3	6%	**106.20**
4	8%	**116.76**
5	10%	**110.12**
6	12%	**102.94**

Tab.5.3 Observations of UCS values of RHA-Soil Mix

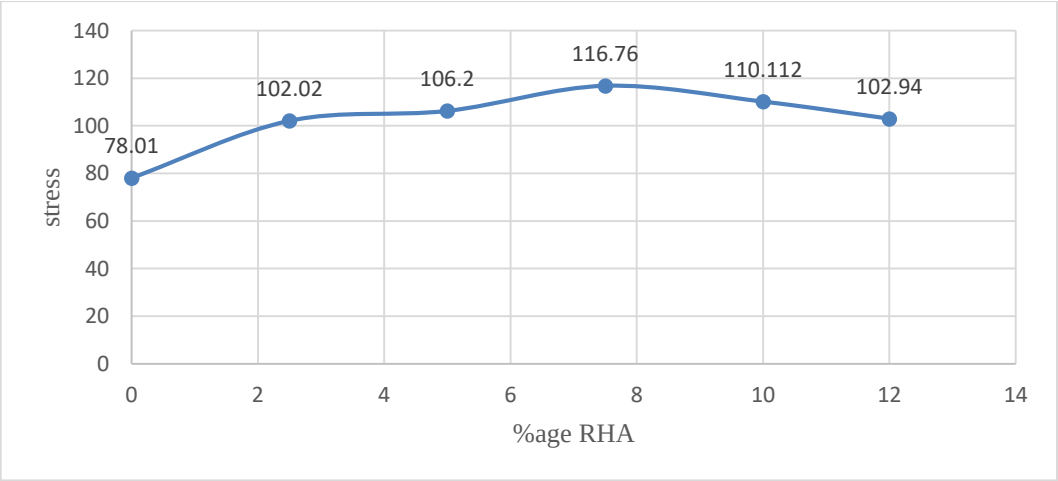

Fig.5.3 percentage of RHA vs Stress

S NO.	RHA%	WPS%	UCS of Soil in (KN/M^2)
1	8	0	116.76
2	8	2.5	143.09
3	8	5	223.01
4	8	7.5	215.55
5	8	10	185.29

Tab.5.4 Observations of UCS values of ESP& PA-Soil Mix

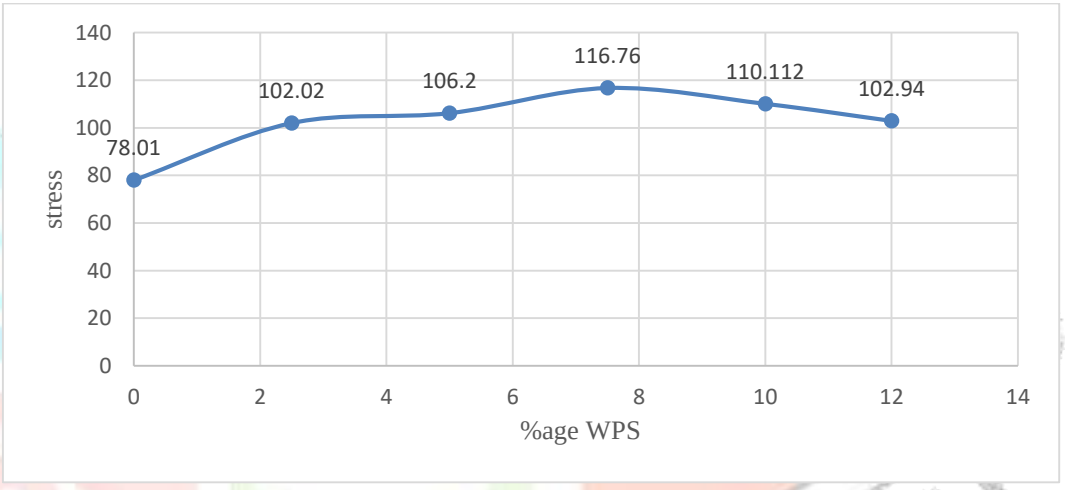

Fig.5.4 Percentage of WPS vs Stress

V. CONCLUSION

- The MDD of the basic soil was found to be 1.971g/cc. The dry density decreases to 1.698g/cc. with increase in percentage of RHA. Further the MDD increases upto 1.987g/cc with increase in percentage of WPS keeping percentage of RHA constant (8%).
- The OMC remains same for the basic soil. For RHA soil mix the OMC increases with increase in percentage of RHA. The OMC remains constant for RHA soil mix stabilised with WPS.
- The UCS value for the basic soil was found to be 78.01KN/m2. The UCS value of the basic soil increases with increase in percentage of RHA and reaches the maximum value of 116.76 KN/m2. The UCS values further increase when soil RHA mix (8% of RHA) is added to WPS at different percentages. The UCS value obtained was 223.01 KN/m2 at 5% WPS.

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