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SOIL STABILIZATION BY USING RECRON -3S, FLYASH & LIME

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Abstract : *In order to operate vehicles more efficiently and effectively, which is necessitated by population increase, highways must be properly designed in terms of geometry and maintained in terms of pavement quality. Earth material is needed in extremely large quantities for a number of infrastructure projects, including those for water reservoirs, railroads, and highways. Highways must be kept in good condition if they are to provide travellers with comfort, convenience, and safety. We'll use RECRON-3S, FLYASH, and LIME in this project to stabilise the soil. Recron-3S is used here as (1%,2%), lime is used as (3%), and fly ash is used as (12%). In California, the bearing ratio value will be higher as compared to standard materials due to varying soil-additive proportions. Additionally, that pavement thickness can be reduced to some amount.*

Keywords - *Soil, recron-3S, fly ash, lime, CBR (California Bearing Ratio) test, Optimum Moisture Content, Maximum dry density.*

I. INTRODUCTION

Any structure built on the ground needs a solid foundation to sustain the entire construction, which is why it is so crucial. The method of stabilising soil aids in giving soil the necessary qualities for construction-related operations. Different techniques were used to increase soil strength etc. by ancient civilizations as the Chinese, Romans, and Incas. The stabilisation of the soil aids in obtaining the qualities in the soil that are necessary for the creation of pavement. Lack of strength is one of the key causes of Pavements' failure. By varying the amounts of the additional components in the sub grade, strength can be improved. Recron produces fantastic results when used with soil, fly ash, and lime. Potholes, pavement degradation, and cracking are just a few of the issues that Recron can fix because it absorbs everything and keeps the road surface in contact.

II. LITERATURE REVIEW

1 Review on different methods of Soil Stabilization [11]
GANESH. M. BHATAWARDE, AJIT C. BABAR & PROF A. A. DANGE

Every civil engineering structure must be safe and stable for that soil above which it is rest should have sufficient shear strength and bearing capacity.here , different soil stabilizer used for soil stabilization they are fly ash , lime , Bitumen , cement and fly ash. About lime Stabilization, he has introduce a proper step-by-step procedure. They all concluded that several methods are implemented for modification of various properties of soil using different soil stabilizer and aslo we can decide the percentage of material added to the soil.

2 Stabilization of Flexible Pavement SubbaLayer Using Recron 3s [13]
P. Sai Gopal Reddy, T. Venkateswara Rao, Nikhita, Dr. R. Ratna Prasad

Now a day's the population and traffic intensity was expanding rapidly and materialCost also increasing. India is enormous nation with immense assets of nearby materials are used for economical purpose of locally accessibleMaterials in the construction of subbase developments and maintain build their

quality.Here the Author has used some soil stabilizer are as follows Recron fibre , Fly Ash , Pond ash, etc. Here the Author concluded Different experimental tests are conducted In the laboratory. Compaction tests and California bearing ratio tests were arranged by Using various combinational % of Recronfiber With fly ash material to identify optimum levelOf fiber.The Author Concluded that The fly ash reinforced with Various Combinational % of Recronfiber performs 0.75 % optimum level of Fiber reinforcement.

3 STUDY OF SOIL STABILIZATION BY USING RECRON - 3S, FLYASH & LIME [14]

Siyyagalla Subbarayudu, S.Rozwana, Y.Susmitha, M.Mallesh &T.Chandrasekhar

The highways have to be maintained so that comfort, convenienceand safety are provided to the travelling public. For any land-based structure, the foundation is very important and has to be strong to support the entire structure. The process of soil stabilization helps to achieve the required properties in a soil needed for the construction work. Here the author has used the materials they are 1.Red Soil 2.fly ash 3.lime 4. Recron & also the Proparation of Red soil. In this project we are going to stabilize the soil by using RECRON-3S, Lime, FLYASH. Here we are using recron-3S as (1%,2%,) lime (2%,3%,4%) and flyash at (10%,12%,15%,20%). With different proportion of soil with additive materials CBR value will be more compare to conventional materials. And from that thickness of pavement can be minimized to the certain extent.The Author concluded that the Strength of soil can be increased to the certain extent by using additive materials in soil. Especially Recron 3s, when mixed with soil and fly ash mixtures gives a wonderful result. Fiber absorbs everything and keeps the road surface intact and many problems can be solved like potholes, cracking &failure of pavements.

4 EXPERIMENTAL STUDY ON THE BEHAVIOUR OF KAREWA SOIL BY USING RECRON FIBRE AND FLY ASH [15]

Addil Bashir Sheikh1, Er. Tripti Goyal

The Soil stabilization is very necessary by the addition of additives in suitable dosages for road pavement foundation because it improves the engineering properties of soil to sustain load carrying capacity in terms of quality and quantity of performance. The author mentioned that the Stabilization of soil is the way toward shifting the properties of soil to improve its designing properties, with the goal that it very well may be utilized in different works of structural building.For the Stabilization of the Soil the Author has used some materials they are Recron& Fly Ash. They also had used some Test they are 1.Standart Proctor Test 2 Direct Shear test and 3.Unconfined Compression Test. The Author Concluded that 1. The maximum dry density decreases and Optimum moisture content increases with the increase in the fibre content in the soil mix.2. The optimum mix is mix 4 containing 12 % fly ash and 0.9 % Recron Fibre.3. The maximum shear stress is achieved as 0.574 by mix 3 containing 0.6 % Recron fibre with 12 % Fly ash4. Strength of soil can be increased to the certain extent by using additive materials in soil. Especially Recron 3s, when mixed with soil gives a wonderful result.

5 Stabilization of soil using flyash, lime, cement [16]

SANTOSH DHAKAR & S. K. JAIN

If good earth is not available at construction site, it becomes imperative to option for soil stabilization. Soil stabilization is process to treat a soil to maintain or improve the performance of soil as construction material. The objective of this paper is to review the application of different stabilizing agent such as fly ash, cement, rise husk, expanded polystyrene geafoam, lime and waste paper sludge for added the improvement of quality on soil stabilization and possible problem of soil stabilization.

III. METHODOLOGY

III.1 MATERIALS

III.1.1 RED SOIL: The soil used in this study is red soil collected at a depth of 1m from the ground level.

Physical Properties of Soil after Testing:
Specific gravity: 2.45
Liquid limit: 40.27%
Plastic limit: 30%
Optimum Moisture Content: 9.35 %
Maximum Dry Density: 1.73 g/cc
CBR value: 2.95

III.1.2 FLY ASH: A by-product of burning pulverised coal in electricity producing plants is fly ash. Mineral impurities in the coal burn in suspension and float out of the combustion chamber with the exhaust gases during the process of combustion.

Parameter Range:
Specific gravity: 2.21
Fineness: 310 m2 /kg
Particle shape: Round

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Colour: Ash

III.1.3 LIME: When making lime mortar, many types of slaked lime are employed. These types of slaked lime are referred to as hydraulic lime because they set by hydration.
Higher compressive strength and a quicker first set are provided by hydraulic lime. Although the phrases hydraulic lime and hydrated lime are very similar and could be mistaken for the same thing, they are not the same thing.

III.1.4 RECRON -3S: The fibre used in this study is a polypropylene fibre, which acts as a stabiliser to improve CBR and UCS values. It is the most widely used synthetic material fibre due to its low cost, hydrophobic, and chemically inert nature, which does not allow the absorption or reaction with soil moisture or leachate.
Physical Properties of Recron -3S
Cut length: 6mm or 12mm.
Tensile strength: 4000-6000 kg/cm2.
Melting point: > 250oC.
Colour: white

III.1.5 WATER: The experiments were conducted using potable water that could be safely consumed.

III.2 PROPORTIONS OF MATERIALS WITH RED SOIL

III.2.1 Soil (100%)
III.2.2 Soil (85%) + Fly ash (12%) + Lime (3%)
III.2.3 Soil (84%) + Fly ash (12%) + Lime (3%) + Recron-3S (1%)
III.2.4 Soil (83%) + Fly ash (12%) + Lime (3%) + Recron-3S (2%)

VI. TESTS &RESULT

From above proportions MDD (Maximum Dry Density) &OMC (Optimum Moisture Content) is calculated.

TableNo.1Result of Standard Proctor Test

S.No	Proportions	OMC(%)	MDD(g/cc)
1	100%S	12.65	1.833
2	85%S+12%F+3%L	12.83	1.825
3	84%S+12%F+3%L+2%R	12.19	1.77
4	83%S+12%F+3%L+1%R	15.74	1.69

From SPT tests after considering the results according to OMC &MDD suitable proportions are listed below.
1. Soil (100%)
2.Soil (84%) + Fly ash (12%) + Lime (3%) + Recron-3S (1%)
3.Soil (83%) + Fly ash (12%) + Lime (3%) + Recron-3S (2%)
From the results of standard proctor test best proportions are selected from their MDD & OMC. Now after performing standard proctor test, California Bearing Ratio test as per IS: 2720 part-16 is to be performed.

1. Soil (100%)

TableNo.2 Result of standard proctor test is listed in table

	1	**2**	**3**	**4**	**5**	**6**
Mass of mould + compacte d soil (g)	6.04	6.18	6.34	6.35	6.39	6.32
Mass of compacte d soil, W_1 (g)	1.75	1.88	2.08	2.06	2.09	2.02
Bulk density	1.74	1.888	2.070	2.066	2.095	2.034
Container No	**1**	**2**	**3**	**4**	**5**	**6**
Mass of container	58.15	40.53	40.29	42.41	41.66	41.35
Mass of	93.45	159.2	100.92	150.85	11584	95.66

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container + wet soil						
Mass of container + dry soil	91.65	149.10	94.1	138.43	103.25	86
Mass of water	1.83	10.17	6.81	12.41	12.58	9.46
Mass of dry soil	33.45	108.66	53.81	96.03	64.23	44.84
Water content %	5.47	9.35	12.65	12.92	19.58	21.15
Dry density	1.646	1.732	1.833	1.828	1.751	1.68

Optimum Moisture Content=12.65%; Dry Density=1.833g/cc

2. 84% Soil + 12% Fly ash + 3% Lime + 1% Recron 3s

TableNo.3 Result of standard proctor test is listed in table

	1	**2**	**3**
Mass of mould + compacted soil (g)	6.03	6.32	6.2
Mass of compacted soil, W_1 (g)	1.73	2.02	1.9
Bulk density	1.73	2.02	1.90
Container no	**4**	**5**	**6**
Mass of container	47.11	42.41	40.25
Mass of container + wet soil	150.22	79.2	78.38
Mass of container + dry soil	143.21	73.31	7320
Mass of water	7.01	5.89	5.18
Mass of dry soil	86.1	30.9	32.95
Water content %	8.14	19.06	15.75
Dry density	1.6	1.64	1.69

Optimum Moisture Content=15.75%; Dry Density=1.69g/cc

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3. 83% Soil + 12% Fly ash + 3% Lime + 2%Recron 3s

TableNo.4 Result of standard proctor test is listed in table

	1	**2**	**3**
Mass of mould + compacted soil (g)	6.20	6.28	6.02
Mass of compacted soil, W_1 (g)	1.89	1.98	1.74
Bulk density	1.89	1.99	1.73
Container no	**1**	**2**	**3**
Mass of container	52.10	42.41	40.24
Mass of container + wet soil	146.58	77.93	76.38
Mass of container + dry soil	138.53	74.06	71.67
Mass of water	8.6	3.84	4.7
Mass of dry soil	86.41	31.65	31.41
Water content %	9.32	12.19	14.95
Dry density	1.59	1.77	1.6

Optimum Moisture Content=12.19%; Dry Density=1.77g/cc

- **CBR TEST**

1. 100% soil

Least count of penetration dial gauge in mm=0.01
Proving ring constant=0.915

TableNo.5

S. No	Dial gauge reading	Penetration in mm 0.01(a)	Proving ring reading (b)	Load in kg (b)*0.91 5
1	0	0	0	0
2	50	0.5	12.2	11.16
3	100	1	24.4	22.33
4	150	1.5	30.2	27.33
5	200	2	36.4	33.31
6	250	2.5	44.4	40.63
7	300	3	49	44.83
8	350	3.5	55	50.32
9	400	4	59.8	54.72
10	450	4.5	63	57.64
11	500	5	64.4	59.84

$$P2.5 = \frac{load\ at\ 2.5\ mm\ penetration}{standard\ load\ at\ 2.5\ mm} \times 100 = \frac{40.626}{1370} \times 100 = 2.96\%$$

$$P5.0 = \frac{load\ at\ 5\ mm\ penetration}{standard\ load\ at\ 5\ mm} \times 100 = \frac{59.84}{2055} \times 100 = 2.91\%$$

2. Soil 84 % + Fly ash 12% + Lime 3% + Recron 1%

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TableNo.6 CBR Test

S. No	Dial gauge reading	Penetration in mm 0.01(a)	Proving ring reading (b)	Load in kg (b)*0.915
1	0	0	0	0
2	50	0.5	33.1	30.29
3	100	1	46.6	42.63
4	150	1.5	52.2	47.76
5	200	2	67.3	61.58
6	250	2.5	76.3	69.86
7	300	3	72.3	72.56
8	350	3.5	80.4	73.57
9	400	4	85.1	77.86
10	450	4.5	90.4	82.72
11	500	5	92.3	84.46

$$P2.5 = \frac{load\ at\ 2.5\ mm\ penetration}{standard\ load\ at\ 2.5\ mm} \times 100 = \frac{69.86}{1370} \times 100 = 5.09\%$$

$$P5.0 = \frac{load\ at\ 5\ mm\ penetration}{standard\ load\ at\ 5\ mm} \times 100 = \frac{84.46}{2055} \times 100 = 4.11\%$$

3. Soil 83% + fly ash12% + lime 3% + Recron 2%

TableNo.7 CBR Test

S. No	Dial gauge reading	Penetration in mm 0.01(a)	Proving ring reading (b)	Load in kg (b)*0.915
1	0	0	0	0
2	50	0.5	23.2	21.22
3	100	1	30.1	27.54
4	150	1.5	45.4	41.54
5	200	2	50.3	46.02
6	250	2.5	53.9	49.32
7	300	3	62.3	57.00
8	350	3.5	68.6	62.76
9	400	4	72.3	66.11
10	450	4.5	79.1	72.37
11	500	5	82.2	75.25

$$P2.5 = \frac{load\ at\ 2.5\ mm\ penetration}{standard\ load\ at\ 2.5\ mm} \times 100 = \frac{53.9}{1370} \times 100 = 3.6\%$$

$$P5.0 = \frac{load\ at\ 5\ mm\ penetration}{standard\ load\ at\ 5\ mm} \times 100 = \frac{75.25}{2055} \times 100 = 3.66\%$$

IV. CONCLUSION

- By adding elements to the soil, the strength of the soil can be increased to some extent. Recron 3s in particular produce fantastic results when used with fly ash and soil combinations.
- Fiber absorbs everything, maintains the integrity of the road surface, and offers several solutions to issues like potholes, pavement failure, and cracking.
- Using the California bearing ratio test, soil strength is assessed.
- Materials can be easily available from themarket.so it is economical. Problems can be eliminated by using additive materials in the sub grade layer of pavement. It can be also used in sub base layer.
- The market may be easily accessed for materials. So it is cost-effective. By adding more materials to the pavement's subgrade layer, issues can be resolved. It may also be utilised as a sub base layer.
- It has been shown that adding additional admixtures decreases LIQUID LIMIT while adding lime fly ash increases it by 3% and 12%, respectively.
- It can be inferred from the particle size analysis curve that the sand is well graded.
- The ideal moisture content was determined by the compaction test to be decreased by adding up to % soil + 12% fly ash + 3% lime + 1% recron and further increased. Up to 84% soil, 12% fly ash, 3% lime, and 1% recron can be added to boost dry density.

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