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

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ABSTRACT: The growth of population has created a need for better and economical vehicular operation which requires good highway proper geometric design, pavement condition maintenance. There are various infrastructure projects which are used in highways, railways, water reservoir etc. which requires earth material in very large quantity. The highways have to be maintained so that comfort, convenience and safety are provided to the travelling public. In this project we are going to stabilize the soil by using RECRON-3S, FLYASH, LIME .Here we are using recron-3S as (1%,2%,) lime(2%,3%,4%) and fly ash at (10%,12%,15%,20%).With different proportion of soil with additive materials California bearing ratio value will be more compare to conventional materials. And from that thickness of pavement can be minimized to the certain extent.

KEYWORDS: soil, recron-3S, fly ash, lime, CBR (California Bearing Ratio) test, Optimum Moisture Content, Maximum dry density.

I. INTRODUCTION

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. Ancient civilizations of the Chinese, Romans and Incas utilized various methods to improve soil strength etc. The process of soil stabilization helps to achieve the required properties in a soil needed for the pavement construction work. One of the main reasons for the failure of Pavements is due to lack of strength. Strength can be increased by adding additive materials to the sub grade in different proportions. Recron when mixed with soil, fly ash and lime it will give wonderful result. Recron absorbs everything and keeps the road surface in contact and many problems can be solved like potholes, cracking and failure of the pavement.

II. MATERIALS

Following are the materials which are used for stabilization of red soil:

a) 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

b) Fly ash: Fly ash is industrial by product that comes from the burning of coal used for the production of electrical energy. .

Parameter	Range
Specific gravity	2..21
Fineness	310 m^2/kg
Particle shape	Round
Colour	Ash

c) Lime: The lime is taken from the market for the purpose of soil stabilization which imparts cementing property to soil mix.

d) RECRON -3S: Recron-3S is most commonly used synthetic fiber due to its low cost, hydrophobic nature, chemically inert and does not allow reaction with soil moisture.it is a polypropylene fiber which is a stabilizer to improve CBR values. Recron -3S fibers are mixed in soil uniformly to get appropriate strength.

Physical Properties of Recron -3S
Cut length: 6mm or 12mm.
Tensile strength: 4000-6000 kg/cm2.
Melting point : > 250oC.
Colour : white.
Source: vasanth enterprise, Reliance industries.

e) WATER: Potable water which was fit for drinking was used for the experiments.

III. PROPORTIONS OF MATERIALS WITH RED SOIL

SPT tests are conducted on soil by different mix proportions.

1. Soil (100%)
2. Soil (88%) + Fly ash (10%) + Lime (2%)
3. Soil (83%) + Fly ash (15%) + Lime (2%)
4. Soil (78%) + Fly ash (20%) + Lime (2%)
5. Soil (81%) + Fly ash (15%) + Lime (4%)
6. Soil (85%) + Fly ash (12%) + Lime (3%)
7. Soil (84%) + Fly ash (12%) + Lime (3%) + Recron-3S (1%)
8. Soil (83%) + Fly ash (12%) + Lime (3%) + Recron-3S (2%)

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

Result of Standard Proctor Test

S.No	Proportions	OMC(%)	MDD(g/cc)
1	100%S	12.65	1.833
2	88%S+10%F+2%L	6.06	1.823
3	83%S+15%F+2%L	12.436	1.7965
4	78%S+20%F+2%L	12.81	1.735
5	81%S+15%F+4%L	12.044	1.735
6	85%S+12%F+3%L	12.83	1.825

7	84%S+12%F+3%L+2%R	12.195	1.77
8	83%S+12%F+3%L+1%R	15.75	1.69

From SPT tests after considering the results according to OMC &MDD suitable proportions are listed below.

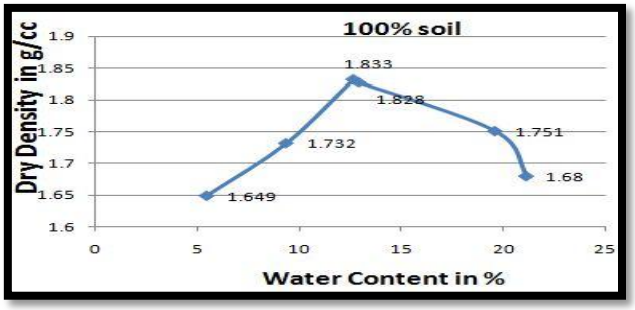
1. Soil (100%)
2. Soil (84%) + Fly ash (12%) + Lime (3%) + Recron-3S (1%)
3. Soil (83%) + Fly ash (12%) + Lime (3%) + Recron-3S (2%)

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%)

Result of standard proctor test is listed in above table and graph is drawn by using that data

	1	**2**	**3**	**4**	**5**	**6**
Mass of mould + compacted soil (g)	6.04	6.19	6.36	6.36	6.39	6.33
Mass of compacted soil, W_1 (g)	1.74	1.89	2.06	2.06	2.09	2.03
Bulk density	1.74	1.894	2.065	2.065	2.095	2.035
Container No	**1**	**2**	**3**	**4**	**5**	**6**
Mass of container	58.17	40.53	40.29	42.42	41.66	41.39
Mass of container + wet soil	93.45	159.29	100.91	150.86	11584	95.66
Mass of container + dry soil	91.62	149.12	94.1	138.45	103.26	86
Mass of water	1.83	10.17	6.81	12.41	12.58	9.46
Mass of dry soil	33.45	108.67	53.81	96.03	64.23	44.81
Water content %	5.47	9.35	12.65	12.92	19.58	21.11
Dry density	1.649	1.732	1.833	1.828	1.751	1.68

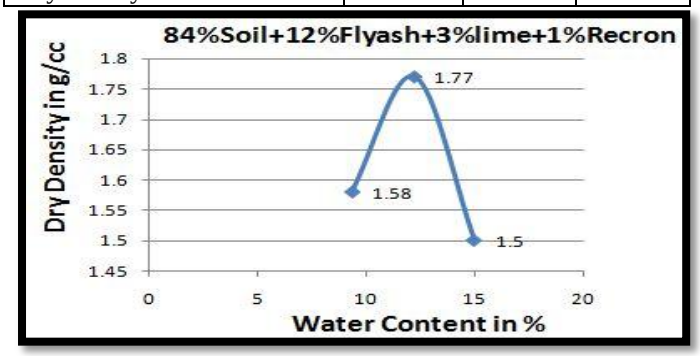


Optimum Moisture Content=12.65%; Dry ensity=1.833g/cc

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

Result of standard proctor test is listed in above table and graph is drawn by using that data

	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	1.734	2.02	1.904
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

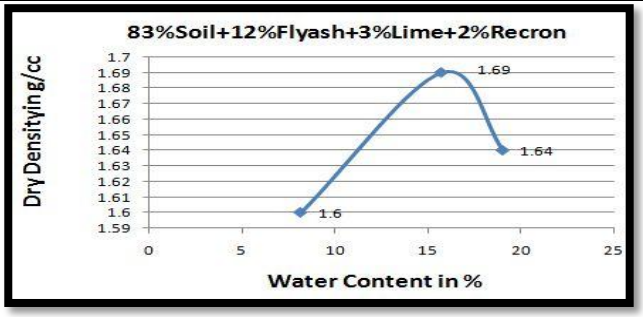


Optimum Moisture Content=15.75%; Dry Density=1.69g/cc

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

Result of standard proctor test is listed in above table and graph is drawn by using that data

	1	**2**	**3**
Mass of mould + compacted soil (g)	6.19	6.29	6.03
Mass of compacted soil, W_1 (g)	1.89	1.99	1.73
Bulk density	1.8948	1.995	1.7344
Container no	**1**	**2**	**3**
Mass of container	52.11	42.41	40.25
Mass of container + wet soil	146.59	77.92	76.37
Mass of container + dry soil	138.53	74.06	71.67
Mass of water	8.6	3.84	4.7
Mass of dry soil	86.42	31.65	31.42
Water content %	9.326	12.195	14.958
Dry density	1.58	1.77	1.5



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

IV. CBR TEST

1. For 100% soil

Least count of penetration dial gauge in mm=0.01

Proving ring constant=0.915

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	12.2	11.163
3	100	1	24.4	22.326
4	150	1.5	30.2	27.33
5	200	2	36.4	33.306
6	250	2.5	44.4	40.626
7	300	3	49	44.835
8	350	3.5	55	50.325
9	400	4	59.8	54.717
10	450	4.5	63	57.645
11	500	5	64.4	59.841

$P2.5 = \frac{\text{load at 2.5 mm penetration}}{\text{standard load at 2.5 mm}} X100 = \frac{40.626}{1370} * 100 = 2.96\%$

$P5.0 = \frac{\text{load at 5 mm penetration}}{\text{standard load at 5 mm}} X100 = \frac{59.841}{2055} * 100 = 2.91\%$

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

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	30.286
3	100	1	46.6	42.631
4	150	1.5	52.2	47.763
5	200	2	67.3	61.578
6	250	2.5	76.3	69.86
7	300	3	72.3	72.56
8	350	3.5	80.4	73.566
9	400	4	85.1	77.86
10	450	4.5	90.4	82.716
11	500	5	92.31	84.463

$P_{2.5} = \frac{\text{load at 2.5 mm penetration}}{\text{standard load at 2.5 mm}} * 100 = \frac{69.86}{1370} * 100 = 5.09\%$

$P_{5.0} = \frac{\text{load at 5 mm penetration}}{\text{standard load at 5 mm}} * 100 = \frac{84.463}{2055} * 100 = 4.11\%$

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

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	46.024
6	250	2.5	53.91	49.32
7	300	3	62.3	57
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	82.24	75.25

$P_{2.5} = \frac{\text{load at 2.5 mm penetration}}{\text{standard load at 2.5 mm}} * 100 = \frac{53.9}{1370} * 100 = \mathbf{3.6}\%$

$P_{5.0} = \frac{\text{load at 5 mm penetration}}{\text{standard load at 5 mm}} * 100 = \frac{75.25}{2055} * 100 = \mathbf{3.66}\%$

V. RESULTS

S. No	Proportions	CBR@2.5MM	CBR@5.00MM
1	100%soil	2.96	2.91
2	84%soil+12%flyash+3%lime+1%recron3s	5.09	4.11
3	83%soil+12%flyash+3%lime+2%recron3s	3.6	3.66

VI. CONCLUSION

1. 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.
2. Fiber absorbs everything and keeps the road surface intact and many problems can be solved like potholes, cracking & failure of pavement.
3. Strength of soil is determined by performing California bearing ratio test.
4. 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.
5. By adding Recron 3s 1% CBR value of soil increased further increasing Recron 3s CBR value decreased.
6. It has been seen that LIQUID LIMIT increases by adding lime fly ash up to 3%, 12% respectively whereas further addition of admixtures decreases it.
7. From the grain size analysis curve it is concluded that it is well graded sand.
8. From the compaction test, optimum moisture content was found decreased by adding up to % soil+12% fly ash+3%lime+1%recronand further increased. Dry density is increased by adding up to 84%soil+12% fly ash+ 3%lime+1%recron.

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