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DESIGN OF FLEXIBLE PAVEMENT USING THE C.B.R. METHOD

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ABSTRACT
California bearing ratio is an empirical test and over the world, it is used for designing the flexible pavement. This method was developed by California Highway Department in 1928. The tests results are used in pavement design, in the duration of second world war. Aim of the study: the main aim of the study is design of flexible pavement using the C.B.R. method Material and method: Tests including Atterberg's (liquid and plastic) limits, shrinkage limits, differential free swelling and swelling pressure as well as OMC and MDD as well as the UCS have all been done to develop the flexible pavement utilising black cotton soil and slurry of Kota stone. Conclusion: Tests are also used to establish the engineering characteristics. The Atterberg's limits (Liquid Limit, Plastic Limit, Plasticity Index), sieve analysis, standard proctor test, and California Bearing Ratio are used to investigate the behaviour of black cotton soil with varying percentages of Kota stone slurry.
Keywords: California Bearing Ratio, Effect on Plasticity Index, Degree of Expansiveness, Maximum Dry Density etc.

1. Introduction

: California bearing ratio is an empirical test and over the world, it is used for designing the flexible pavement. This method was developed by California Highway Department in 1928. The tests results are used in pavement design, in the duration of second world war.
Aim of the study: the main aim of the study is design of flexible pavement using the C.B.R. method
Material and method: Tests including Atterberg's (liquid and plastic) limits, shrinkage limits, differential free swelling and swelling pressure as well as OMC and MDD as well as the UCS have all been done to develop the flexible pavement utilising black cotton soil and slurry of Kota stone.
Conclusion: Tests are also used to establish the engineering characteristics. The Atterberg's limits (Liquid Limit, Plastic Limit, Plasticity Index), sieve analysis, standard proctor test, and California Bearing Ratio are used to investigate the behaviour of black cotton soil with varying percentages of Kota stone slurry.

1.1 CBR METHOD OF DESIGN

The California Bearing Ratio (CBR) method of pavement gives the total thickness requirement of the pavement above a subgrade the CBR method performs on soil sample is based on the strength parameters of subgrade soil and subsequent pavement material

2. Experimental Methods or Methodology

Atterberg's limit (liquid limit and plastic limit), Shrinkage limit, Differential free swelling, Swelling pressure, OMC and MDD, UCS and other studies have been done to develop the flexible pavement utilising black cotton soil and Kota stone slurry. It is possible that the proportion of Kota stone slurry ranged from 5% to 30% by 5% fluctuation.

3. Results and Discussion

3.1 Black Cotton Soil, Kota Stone Slurry, and Mix Specimen Engineering Properties

Laboratory tests on black cotton soil, Kota stone slurry, and mix specimens reveal the following engineering properties:

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Table 1 Properties of BCS, KSS and mix specimens in terms of engineering

Properti es	Black Cotton Soil	Kota Stone Slurry	Mix Specimen
Specific Gravity	2.44	2.35	-
Liquid Limit (%)	41.41	34.28	13.01 – 40.38
Plastic Limit (%)	18.46	21.77	09.16 – 18.01
Plasticity Index (%)	22.95	12.51	03.85 – 22.37
Shrinkage Limit (%)	14.58	-	12.99 – 20.44
Differential Free Swell (%)	53.55	-	04.55 – 36.84
Swelling Pressure (kg/cm^2)	1.1	-	00.09 – 01.09
IS Classification	CI	CL	CI to CL
Maximum Dry Density (kg/cm^3)	1.725	1.635	1.615 – 1.755
Optimum Moisture Content (%)	17.4	17.1	14.5 – 16.2
Colour	Red – Brown	Grey Dirty White	Light Red - Brown

Black cotton soil and Kota stone slurry are blended at various percentages ranging from 5% to 30%. Test results are given in Table 1 for comparison purposes. There is a drop in the plasticity index as the proportion of Kota stone slurry rises. The black cotton soil's behaviour shifts from CI to CL due to plasticity criterion.

3.2 California Bearing Ratio (CBR)

Subgrade bearing ratio values are utilised for flexible pavement design in accordance with IRC recommendations. California bearing ratio is a key soil metric for the construction of flexible pavements and runways at aviation fields. According to IS 2720 (Part 16) – 1979, the test is carried out. The University Teaching Department, RTU, Kota, conducts the California bearing ratio test on black cotton soil and soil mix specimens. Samples of Black cotton soil and a mix specimen are shown in Table 2..

Table 2 CBR test load for the soil and mix specimen in black cotton

Specimen/ Penetration	2.5 mm	5.0 mm	7.5 mm	10.0 mm	12.5 mm
Black Cotton Soil (BCS)	111.2 8	157.04	177.32	188.7 6	199.68
BCS + 5% KSS	168.4 8	235.04	280.8	317.7 2	348.4
BCS + 10% KSS	187.2 0	255.32	291.72	322.4 0	349.96
BCS + 15% KSS	199.6 8	292.76	339.56	369.2	376.48
BCS + 20% KSS	173.1 6	239.20	281.32	313.5 6	345.28

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BCS + 25% KSS	166.4 0	230.36	266.24	281.3 2	287.04
BCS + 30% KSS	173.1 6	220.48	260.52	276.1 2	276.12

Using IS 2720 (Part 16) – 1979, corrections are made to CBR machine loads to determine corrected loads, according to IS 2720 (Part 16). Test load is the name given to this kind of load. Test loads for black cotton soil and mix specimens are presented in Table 3.

Table 3 Black cotton soil and mix specimens have a CBR adjusted load value

Specimen/ Penetration	2.5 mm	5.0 mm	7.5 mm	10.0 mm	12.5 mm
Black Cotton Soil (BCS)	150	172	188	198	210
BCS + 5% KSS	210	264	302	337	365
BCS + 10% KSS	218	270	304	332	360
BCS + 15% KSS	240	318	350	372	378
BCS + 20% KSS	210	264	300	330	365
BCS + 25% KSS	209	252	278	286	290
BCS + 30% KSS	200	258	272	278	270

Only penetration values of 2.5 and 5.0 mm are taken into account, in accordance with IRC guidelines. Table 4 shows the California bearing ratio based on the revised test data.

Table 4 CBR value for Black cotton soil and mix specimen

Specimen/ Penetration	2.5 mm	5.0 mm	7.5 mm	10.0 mm	12.5 mm
Black Cotton Soil (BCS)	10.95%	8.37%	7.15%	6.23%	5.83%
BCS + 5% KSS	15.33%	12.85%	11.48%	10.60 %	10.14 %
BCS + 10% KSS	15.91%	13.14%	11.56%	10.44 %	10.00 %
BCS + 15% KSS	17.52%	15.47%	13.31%	11.70 %	10.50 %
BCS + 20% KSS	15.33%	12.85%	11.41%	10.38 %	10.14 %
BCS + 25% KSS	15.26%	12.26%	10.57%	8.99%	8.06%
BCS + 30% KSS	14.60%	12.55%	10.34%	8.74%	7.50%

Design of flexible pavements utilises the highest possible coefficient of friction (CBR). The specimen with the highest CBR value was a black cotton soil and 15% Kota stone slurry combination.

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CONCLUSION

- If you add more Kota Stone Slurry, the black cotton soil's CI to CL behaviour is altered. Inorganic clay with limited plasticity makes up the Kota stone slurry.
- The relationship between traffic volume and the resulting value of N is well-established. - The overall thickness of flexible pavement grows as the volume of traffic increases.
- The msa value is directly related to pavement thickness and traffic volume, as is the million standard axles (msa) value.
- The overall thickness of the pavement grows as traffic volume increases because of the granular sub foundation and the wear course..

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