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Improvement of Bounce Characteristics on Locally Available Soil to Prepare Cricket Pitches

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Abstract: ***Cricket is one of the most popular sport in the world. Games progresses on hard and flat surface known as pitch. A model of pitch was developed with soil and aggregate to scrutinize their behaviours. The physic of pitches fluctuate from country to country. A model of pitch was generated to observe its characteristics. Usually in India pitches may be too slow and less bouncy in contrast with Australia and South Africa. Ball is allowed to fall under gravity on the pitch model from a height of 2 meters and bounce is observed. Bounce quality is measured by Enguage Digitilizer.A relationship is generated between compaction and vertical bounce.Inorder to create a fast and bouncy pitches to make the Indian players to perform in oversees this paper emphasis about the inclusion of calcium bentonite in varying percentages of 5,10,15,&20. From the data observed 15% bentonite is observed as optimum for the generation of pitch model.***
Keywords: ***Calcium bentonite, Red soil, Vertical bounce, CBR***

I. INTRODUCTION

Cricket pitch preparation is an enjoyable and important role in the world of cricket. Good pitches promote the game and develop good cricketers. The performance of a cricket match varies with pitch quality. A good cricket pitch revels a keen contest between bat and a ball. Cricket pitches have the following characteristics like good pace, consistent bounce, good ball carry and conducive for stroke play. played is very important. Weather, playing surface, ground conditions and many other variables play a part. Especially important among these is the playing surface also called the "Cricket Pitch". Unlike many other sports, the playing area is not artificial and as a result the playing conditions in each game are unique. Cricket pitches have over the years been categorized according to their behaviour. Players have learnt to adapt to how the pitches behave in order to perform better. Of these categories of pitches, the most common are the "fast" and "slow" pitches. "Fast" pitches quite commonly are "bouncy" pitches as well while "slow" pitches tend to be "low", dusty and conducive to "spin".The present study deals with preparation of fast and bouncy pitches by using a mixture of locally available soil and various binders.

II. MATERIALS AND METHODOLOGY

A. Soil

Required soil sample may be collected from Neyyatinkara region usually high land. The geotechnical properties of the soil sample is shown on table 1.The soil sample may be mixed with bentonites of varying percentages of 5,10,15,20.The soil may be classified as MI according to Indian standards.Image of the soil sample is shown below as figure 1

Fig 1. Image of soil

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TABLE 1.PROPERTIES OF SOIL

PROPERTIES	VALUES
Dry unit weight (gm/cm^3)	1.631
Moulding water content (%)	10
Uniformity coefficient	6.7
Coefficient of curvature	2.14
IS classification	MI
Specific gravity	2.23
Percentage of gravel (%)	3.98
Percentage of sand (%)	94.97
Percentage of clay and silt(%)	1.05

B. Bentonite

Bentonite used in this study mainly comprises of calcium ions as their major constituent. The material was collected from Ernakulum District. A clayey material which enhances the properties of soil by its addition in varying percentages proves an efficient way in increasing the strength parameters of the soil. Bentonite thus added to the soil includes 5%, 10%, 15%, and 20% by weight respectively.

Figure 2.Bentonite

TABLE 2. PROPERTIES OF CALCIUM BENTONITE

SOIL PROPERTIES	VALUES
Specific gravity	2.26
Liquid limit (%)	110
Plastic limit (%)	46
Plasticity index (%)	64
OMC (%)	19.38
Dry density (g/cc)	1.46
% clay	77.5
% silt	16.2
% sand	6.3
UCC strength (kN/m^2)	92.33
Free swell index	6.27
IS classification	CH

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C. Aggregates

Aggregates are crushed rock particles of several sizes which provides strength when used for various purposes. These are used in the construction of cricket pitches. Usually aggregate of size 10 mm are normally selected. Drainage systems are provided through aggregate so that the excess water present in pitch may penetrate downward due to gravity and will flow out of pitch through drainage pipes. It also acts as a good sub grade for the soil above.

Figure 3. Aggregate

III. RESULTS AND DISCUSSIONS

A. Effect of Dry Density on Soil Sample

Bentonite is added to soil sample 2 with varying percentage of 5%,10%,15% and 20% maximum dry densities are noted and optimum is determined. Maximum dry density and optimum moisture content for various mix proportion is listed below.

Table 3. Compaction test results for varying percentage of bentonite in soil sample 2

Slno	Mix proportions	Dry density (gm/cc)	OMC (%)
1	Soil	1.753	8
2	Soil + 5% bentonite	1.812	10
3	Soil + 10% bentonite	1.858	12
4	Soil + 15% bentonite	2.01	14
5	Soil + 20% bnetonite	1.836	16

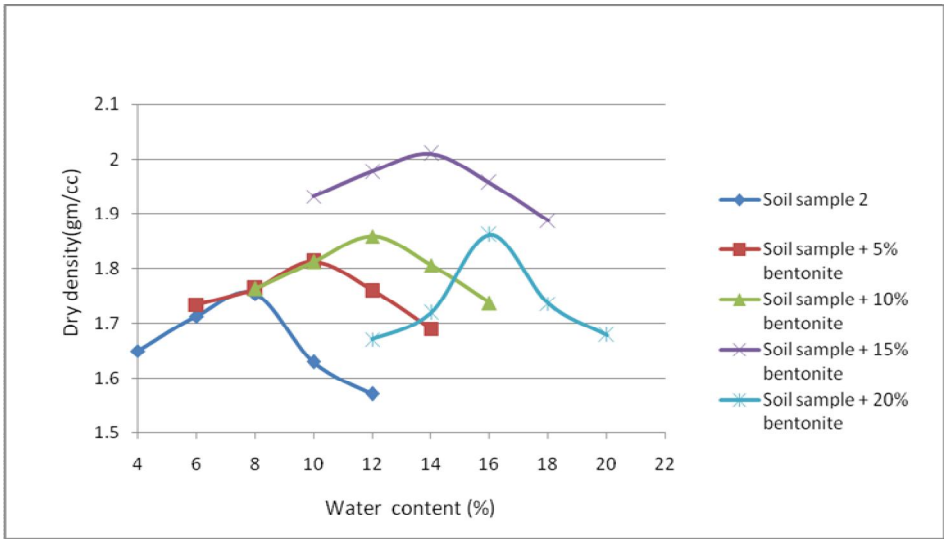

Fig 4. Combined compaction curve for Soil with varying bentonite content

From the graph maximum dry density is 2.01 gm/cc and it is occurred at a bentonite of 15% by weight.

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B. Effect of Bentonite in CBR Value of Soil

From standard proctor compaction test maximum dry density is obtained on Soil-15 % bentonite mix proportion. so CBR test were conducted with varying percentage of bentonite. The CBR value of the soil and soil + 15% bentonite are 2.5 and 4.86 respectively. CBR value is shown in the below table.

Table 4. Cbr test results for varying percentage of bentonite content

Sl no	Mix proportion	CBR value
1	Soil	2.5
2	Soil +5% bentonite	3.43
3	Soil +10% bentonite	3.93
4	Soil +15% bentonite	4.86
5	Soil +20% bentonite	4.18

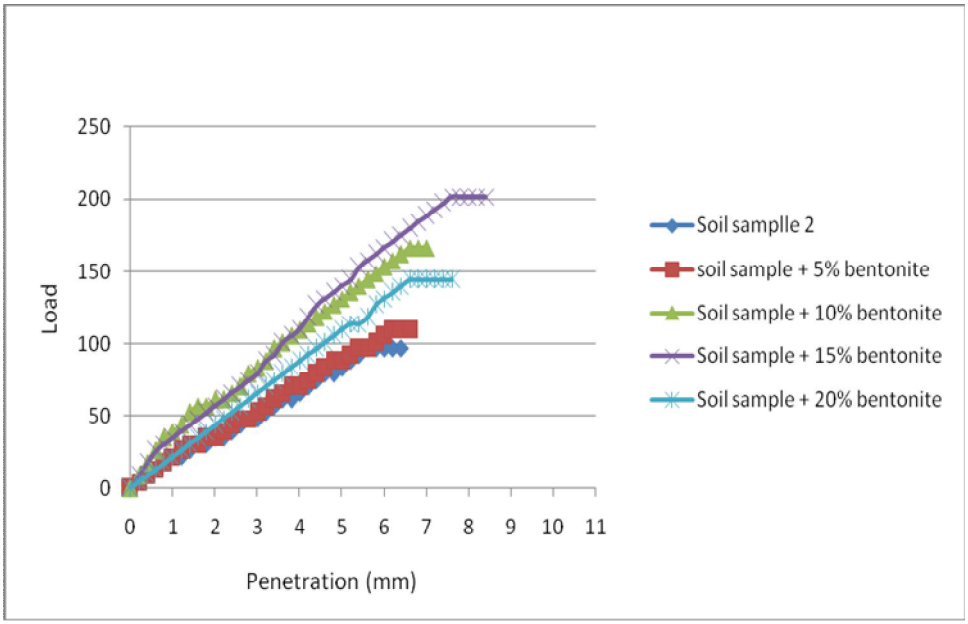

Fig 5. Combined CBR curve for Soil with varying bentonite content

C. Vertical Bounce Test

Image for maximum bouncing back is taken and by using Engauge Digitizer software the value of ball bouncing back is calculated and listed below table.

Table 5. Variation of vertical bounce in sample 2 with varying percentage of bentonite

Sl no	Mix proportion	Vertical bounce value (cm)
1	Soil	6.8
2	Soil + 5% bentonite	26.35
3	Soil + 10% bentonite	33.97
4	Soil + 15% bentonite	45.16
5	Soil + 20% bentonite	41.68

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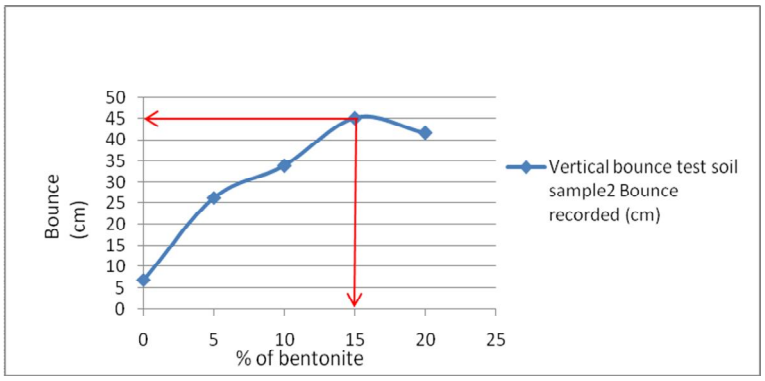

Fig 6. Variation of bounce with bentonite content

From the data recoded, it is clear that maximum bounce occurred for mix proportion soil + 15% of bentonie and the corresponding value is 45.16cm.

IV. CONCLUSIONS

Calcium bentonite has positive nature of increasing the bounce characteristics of soil. By adding various bentonite to soil at varying percentage it is clear that for 15% of bentonite the dry density will be maximum and further addition of bentonite will cause decrease in dry density. Change in CBR value is also noted that upto 15% of bentonite content the CBR value increases positively and then it decreases gradually. Bounce characteristics of soil is improved by 45.16 cm by the addition of bentonite. The initial clay content of soil is 15% and by adding 15%of bentonite will act as a binder provides better bounce property to the soil. From the CBR test and vertical bounce test it can be concluded that CBR value is directly proportional to the vertical bounce.

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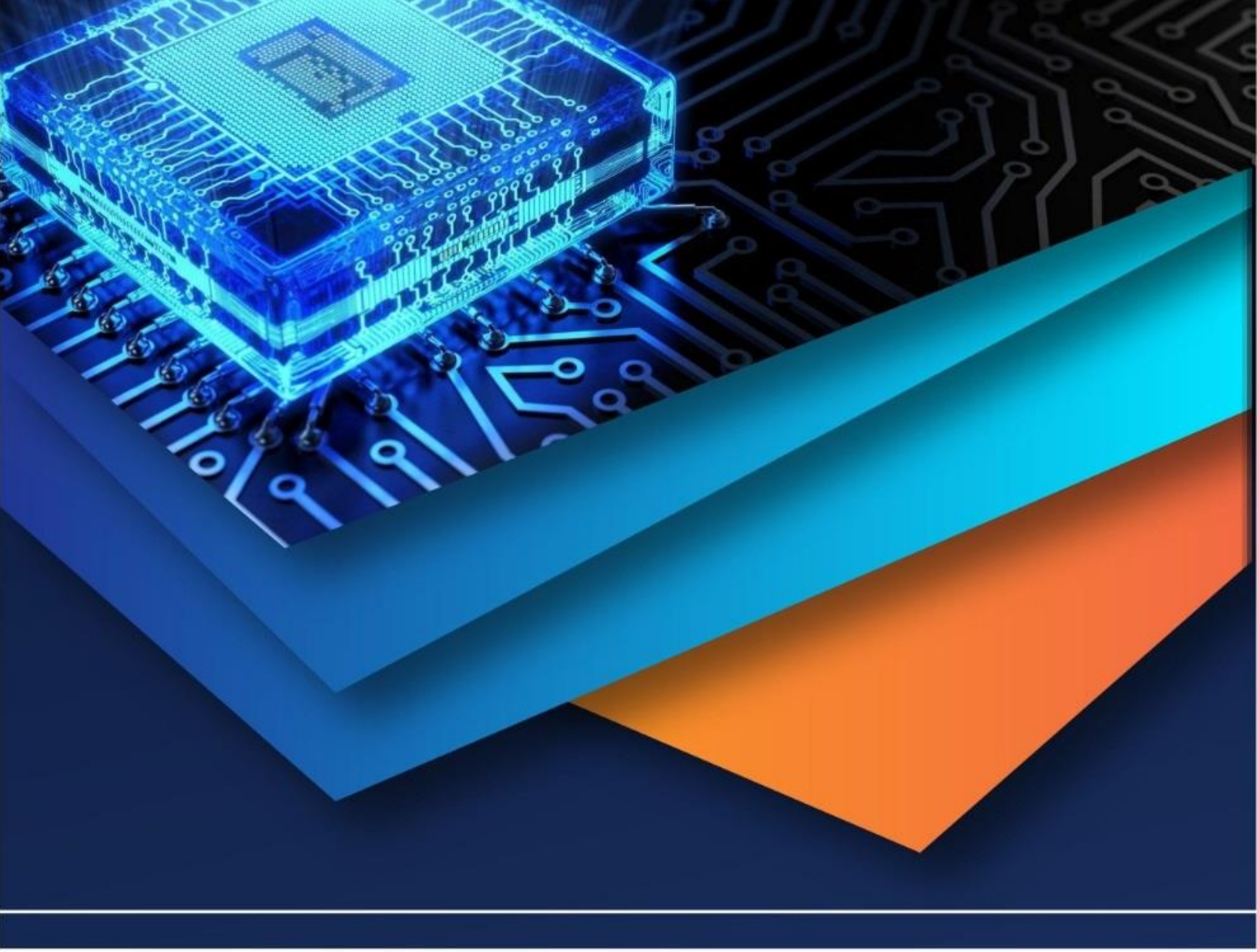

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