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# Utilization of Lateritic Soil to Make Fast and Bouncy Cricket Pitches

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**Abstract:** ***Cricket pitch is a playing arena where soils are ideally packed. As cricket found its origin in England had seized the heart of the people and become an influential factor in controlling the economy of the world. A pattern of pitch was developed with soil, bentonite and aggregates to scrutinize their behaviors. Usually in Asian subcontient pitches are slow and less bouncy. In order to generate a fast and bouncy pitch in India and to meet the current challenge. This paper reveals about the addition of calcium bentonite with locally available soil and generated a relationship between California bearing ratio with vertical bounce. This project tried to address this problem by investigating the possibility of improving the soils used in local cricket pitches in order to make them produce 'fast & bouncy' pitches.***

**Keywords:** Lateritic soil, calcium bentonite, cbr, vertical bounce.

## 1. Introduction

Cricket finds its origin in England in the late 16th century. It is a very complicated game with many facts to be considered like pitch conditions weather and oldage of ball. In Cricket, the condition by which the game is to be played is very influential. One of the most crucial factor that rules the sport is the playing surface known as the "Cricket Pitch". Good playing surface should be hard and flat. Properly compacted soil strata provides a better cricket pitch. To create a fast and bouncing pitch with locally available lateritic soil, bentonite is used as additivies. Bentonite composing of non swelling minerals such as quartz, feldspars, micas and carbonate, void and sand. Introduction of additives will increase the strength of soil strata. The effectiveness of cricket pitch depends on the height of ball rebound. The rebounce of cricket pitch is calculated by using vertical bounce test. Rebound height can be obtained via image processing.

## 2. Materials and Methods

### 2.1 Lateritic Soil

Lateritic soil is most abundantly distributed soil along south india. Laterite is a soil and rock type rich in iron and aluminium. Soil for this study is collected from vizhinjam, Trivandrum. Properties and figure of soil sample is mentioned in table 1 and figure 1 respectively

**Table 1:** Properties of lateritic soil

| *PROPERTIES* | *VALUES* |
|---|---|
| Dry unit weight (gm/cm$^3$) | 1.631 |
| Moulding water content (%) | 10 |
| Uniformity coefficient | 6.7 |
| Coefficient of curvature | 2.14 |
| Specific gravity | 2.23 |
| IS classification | |
| Percentage of gravel (%) | 3.98 |
| Percentage of sand (%) | 94.9 |
| Percentage of clay and silt(%) | 1.04 |

**Figure 1:** Collected sample of lateritic soil.

### 2.2 Bentonite

Bentonite is a form of clay which comprises of montmorillonite. Bentonite used in this study mainly comprises of calcium ions as their major constituent. The material was collected from Vytilla region in Ernakulam 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. Table 2 shows the properties of calcium bentonite and image of calcium bentonite is shown in figure 2.

**Table 2:** Properties of bentonite

| *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 |

**Figure 2:** image of calcium benonite

### 2.3 Aggregate

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 subgrade for the soil above.Figure 3 shows the image of aggregate.

**Figure 3:** 10mm size aggregate

## 3. Result and Discussion

### 3.1 Compaction Characteristics

Lateritic soil is mixed with varying percentage of bentonite. From compaction curve it is observed that 30% of bentonite by weight is recorded as optimum. Table 3 shows the varing mix proportion of soil-bentonite and its optimum dry density and optimum water content. Figure 4 shows the compaction curve for different mix proportions.

**Table 3:** Optimum dry density and omc for various mix

| *Sl No* | *Mix proportions* | *Optimum dry density (gm/cc)* | *Optimum moisture content (%)* |
|---|---|---|---|
| 1 | Soil | 1.631 | 10 |
| 2 | Soil + 10 % bentonite | 1.730 | 12 |
| 3 | Soil + 20 % bentonite | 1.843 | 14 |
| 4 | Soil + 30 % bentonite | 1.861 | 16 |
| 5 | Soil + 40 % bentonite | 1.773 | 18 |
| 6 | Soil + 50 % bentonite | 1.742 | 18 |

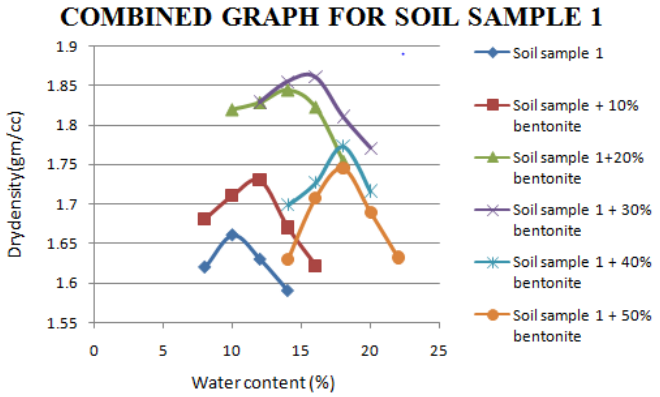


**Figure 4:** Compaction curve for different mix proportion

### 3.2 CBR characteristics

Soil is mixed with varying percentage of bentonite and cbr test is carried out for all the mix proportion according to IS:2720(part 16)-1987. Cbr values increases upto 30% and thereafter it decreases. Table 4 shows the cbr value of different soil bentonite mix and fig 5 shows the cbr graph for different mix proportions.

**Table 4:** CBR value for different mix

| *Sl no* | *Mix proportions* | *CBR value* |
|---|---|---|
| 1 | Soil | 3.24 |
| 2 | Soil + 10% bentonite | 3.74 |
| 3 | Soil + 20% bentonite | 4.37 |
| 4 | Soil + 30% bentonite | 5.43 |
| 5 | Soil + 40% bentonite | 4.98 |
| 6 | Soil + 50% bentonite | 4.46 |

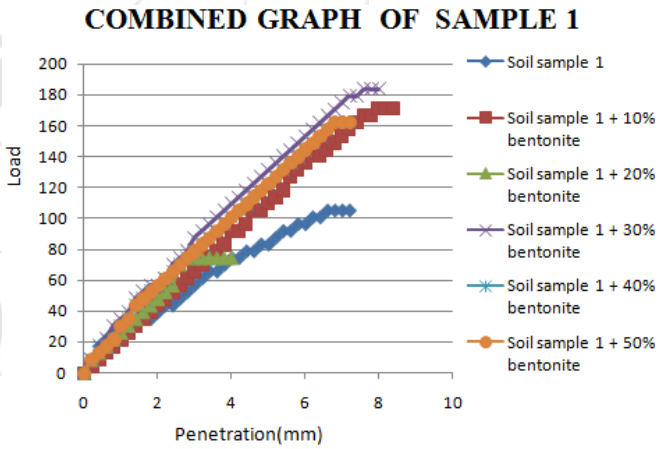


**Figure 5:** CBR values for different mix proportions

### 3.3 Image processing of vertical bounce test

In vertical bounce test cricket ball is allowed to fall freely from a height of 2 m into the prepared pitch model. By image processing the rebound height is noted and it is found that upto 30% of bentonite content bounce value increases and then it decreases. Table % shows the variation of bounce with varying bentonite content. Fig 6 shows the variation of bounce with bentonite content.

**Table -5** variation of bounce for distinctive mix proportions

| *Sl no* | *Mix propotions* | *Vertical bounce value (cm)* |
|---|---|---|
| 1 | Soil | 9.26 |
| 2 | Soil +10% bentonite | 19.25 |
| 3 | Soil +20% bentonite | 35.93 |
| 4 | Soil +30% bentonite | 60.2 |
| 5 | Soil +40% bentonite | 24.62 |
| 6 | Soil +50% bentonite | 19.61 |

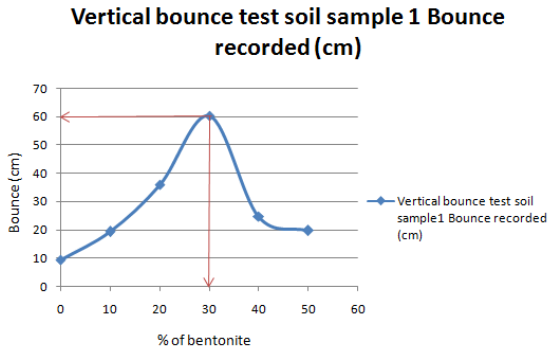


**Figure 6:** Variation of vertical bounce with varying percentage of bentonite content

## 4. Conclusions

- Dry density increases eventually upto 30% bentonite for soil sample and thereafter it decreases.
- Hike in the cbr value is noted when percentages of bentonite levels upto 30% of bentonite.
- From the image processing it is shown that the maximum bounce occurred at 30% of bentonite and corresponding value is 60.2 cm.
- For the optimum percentage of bentonite, the vertical bounce increases to 5.5 times than that of original state.
- Value of vertical bounce test shows that cbr value of soil is directly proportional to the vertical bounce.
- Optimum value of bounce is observed for samples having 30 % of clay content.

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## Author Profile

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