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# Improvement of the Geotechical Properties of Soil by Adding Calcium Carbide Residue and FLY-ASH

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***ABSTRACT***
*The main ideal of this experimental study is to ameliorate the parcels of the soil by adding the waste material which can beget environmental pollution. Calcium Carbide Residue and Fly Ash admixture which are desolate product of acetylene gas manufactories and sword factory independently has been named to add in the soil sample in different rates. The soil parcels with and without adding of waste accoutrements (Calcium Carbide residue and Fly Ash) have been studied. An attempt has been made to use this waste material for perfecting the strength and CBR values of soil which will also prove terrain friendly. Therefore, from this experimental study will help in reduction of pollution and enhancement of soil strength.*
***Keywords:*** *UCS, CBR, Calcium Carbide residue and Fly Ash*

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## I. INTRODUCTION

From the starting of construction work, the significance of enhancing soil parcels has come to the light. Ancient societies of the Chinese, Indian, Romans and Incas employed colorful styles to ameliorate soil strength etc., and these styles were so effective that they're still used in constructing structures and roads. Then, in this design, our whole work revolves around the parcels of soil and its stability. Principally for any structure, the foundation has the precedence significance not strong foundation means not safe structure and the foundation depends a lot on the soil hard. Soil with advanced stability has further strong foundation and therefore having veritably strong and durable structure. So in short we can say that the whole structure on any construction related effects laterally or directly depends on the soil stability. Therefore for any construction work we need to have proper knowledge about soil and its parcels and the factor affecting the soil. After the inception of ultramodern period in India after 1970's the deficit of land comes in front. We had to do construction over the weak soil, therefore it come necessity to ameliorate the strength of the soil at the construction point and also colorful styles come to ameliorate the soil stability. Lots of farther work is done after that in this field and addition of Calcium Carbide Residue and Fly Ash is the new way for this and it seems relatively salutary as these are the waste products of manufactories and can beget environmental pollution.

### 1.1. Calcium Carbide Residue (CCR)

It's by- product of Acetylene gas product Process which is a slurry that substantially contains Calcium Hydroxide ($Ca(OH)_2$) along with $SiO_2$, $CaCO_3$ and other essence oxides. In India, there are numerous Acetylene Gas manufactories and PVC Chemical shops which produces CCR in large quantum which is substantially ditched in the tips causing environmental profanations due to its alkalinity. CCR product is described in the following equation;

$$\mathbf{CaC_2 + 2H_2O \longrightarrow C_2H_2 + Ca(OH)_2}$$

### 1.2. FLY ASH

It's one of the remainders formed in combustion, and consists of the fine patches that rise with the stovepipe feasts. Fly ash is captured from the chimneys of coal- fired power shops. It substantially consists of $SiO_2$ and $Al_2O_3$ due to which it's pozzolanic in nature. It has a large uniformity measure and it consists of complexion sized patches. The cover ash manufacture in India is around 100 million ton per time which pollutes swash water that jeopardize submarine and mortal life. It has pH nearly between 10 and 12, a medium to strong base. This can also beget lung damage if present in sufficient amounts.

## II. MATERIALS USED

### 2.1 SOIL

The soil sample was located from near the boys hostel, SIT Bhubaneswar, Near bank of Mahandi, Cuttack and Near Pahala, Bhubaneswar

**Figure 1: Soil Sample-1**

**Figure 2: Soil Sample-2**

**Figure 3: Soil Sample-3**

### 2.1 FLY ASH

The Fly ash was collected from Cuttack, Odisha.

**Figure 4: Soil Sample-1**

**Table 1: Properties of soil sample-1**

| SL. NO. | PROPERTIES | VALUE |
|---|---|---|
| 1 | Specific gravity | 2.77 |
| 2 | Optimum moisture content (%) | 12.86 |
| 3 | Maximum Dry Density (gm/cc) | 2.08 |
| 4 | U.C.S (Mpa) | 0.085 |
| 5 | C.B.R (%) | 29 |

**Table 2: Properties of soil sample-2**

| SL. NO. | PROPERTIES | VALUE |
|---|---|---|
| 1 | Specific gravity | 2.66 |
| 2 | Optimum moisture content (%) | 13.10 |
| 3 | Maximum Dry Density (gm/cc) | 1.83 |
| 4 | U.C.S (Mpa) | 0.081 |
| 5 | C.B.R (%) | 35.5 |

**Table 3: Properties of soil sample-3**

| SL. NO. | PROPERTIES | VALUE |
|---|---|---|
| 1 | Specific gravity | 2.72 |
| 2 | Optimum moisture content (%) | 16.83 |
| 3 | Maximum Dry Density (gm/cc) | 1.97 |
| 4 | U.C.S (Mpa) | 0.069 |
| 5 | C.B.R (%) | 25.7 |

## III. RESULT AND DISCUSSION

### 3.1 PARTICLE SIZE DISTRIBUTION TEST

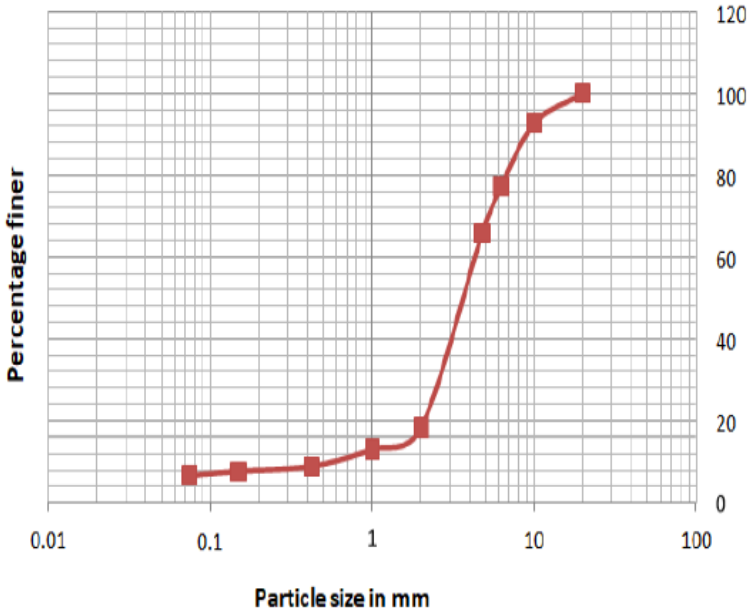


**Figure 5: Particle size curve of Soil sample-1**

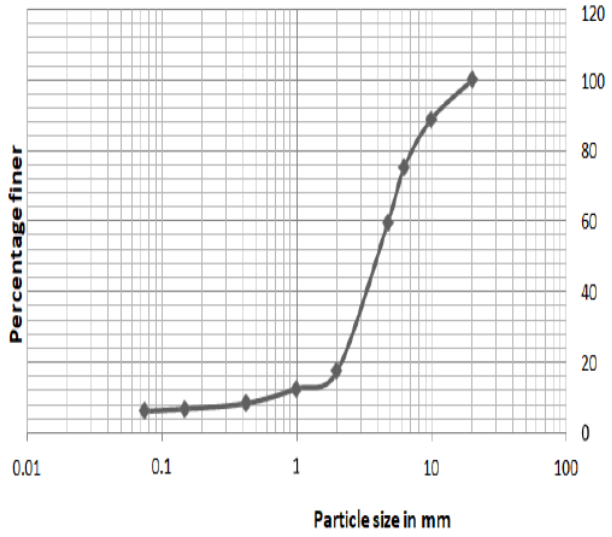


**Figure 6: Particle size curve of Soil sample-2**

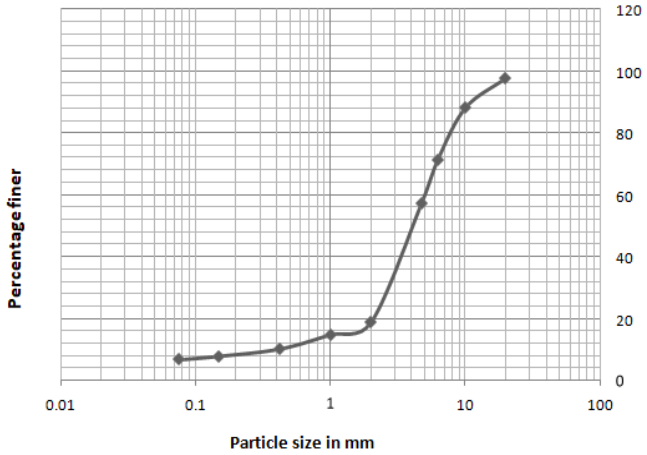


**Figure 7: Particle size curve of Soil sample-3**

### 3.2 COMPACTION TEST

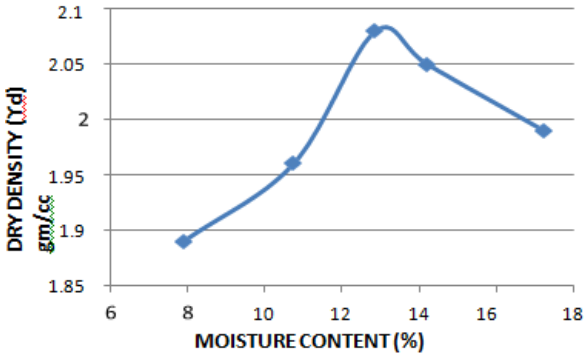


**Figure 8: Compaction curve for Soil sample-1**

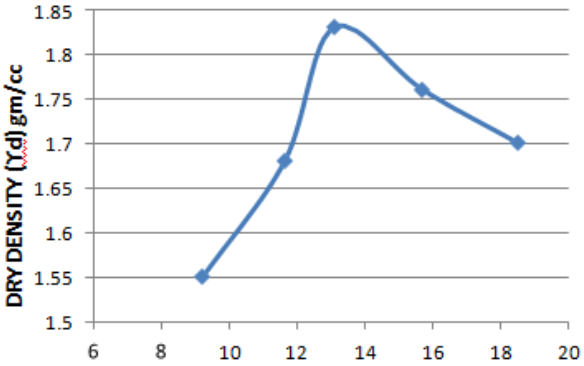


**Figure 9: Compaction curve for Soil sample-2**

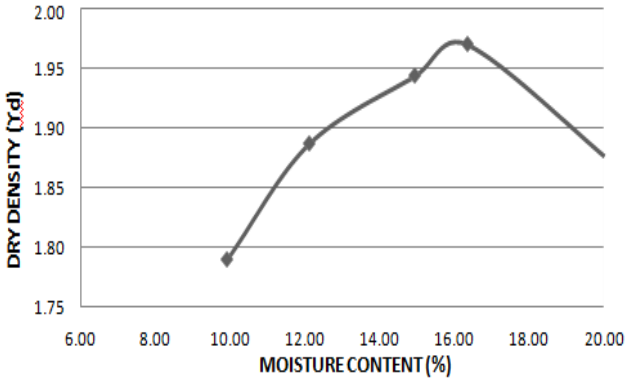


**Figure 10: Compaction curve for Soil sample-3**

### 3.3 UNCONFINED COMPRESSION TEST

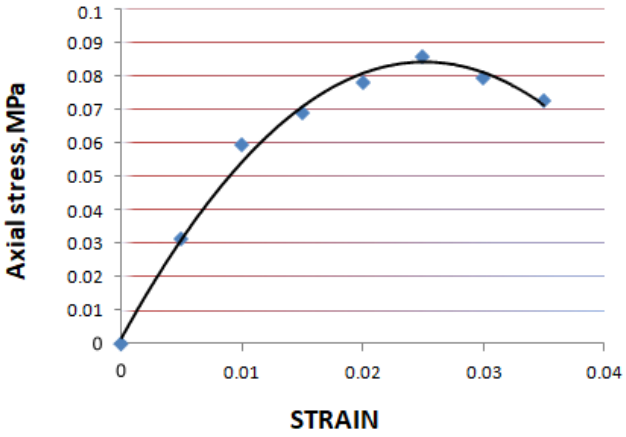


**Figure 11: UCS curve for Soil sample-1**

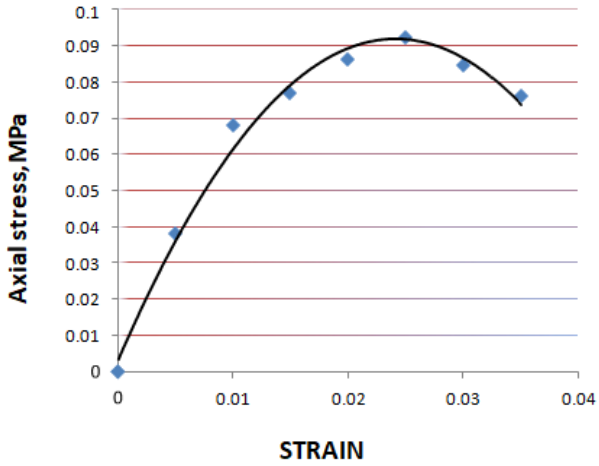


**Figure 12: UCS curve for Soil sample-1 with 10% of CCR and FA mixture**

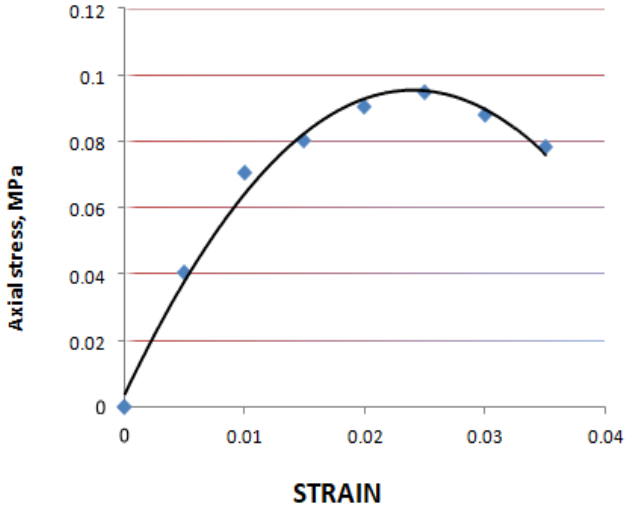


**Figure 13: UCS curve for Soil sample-1 with 15% of CCR and FA mixture**

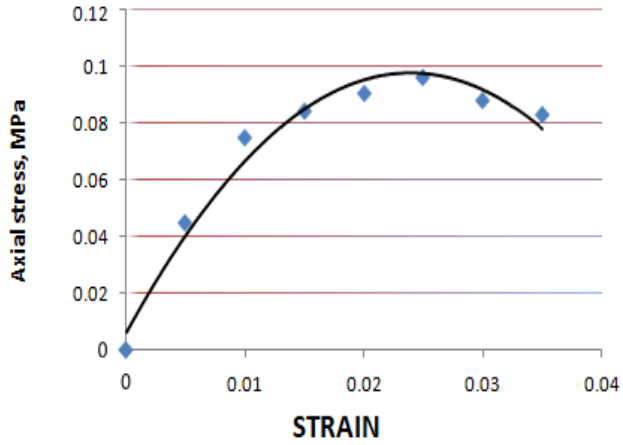


**Figure 14: UCS curve for Soil sample-1 with 20% of CCR and FA mixture**

The unconfined compression value for Soil sample-1 with and without CCR and FA for different proportion of mixture such as 10%, 15% and 20% was 0.085Mpa, 0.092Mpa, 0.094Mpa and 0.095Mpa.

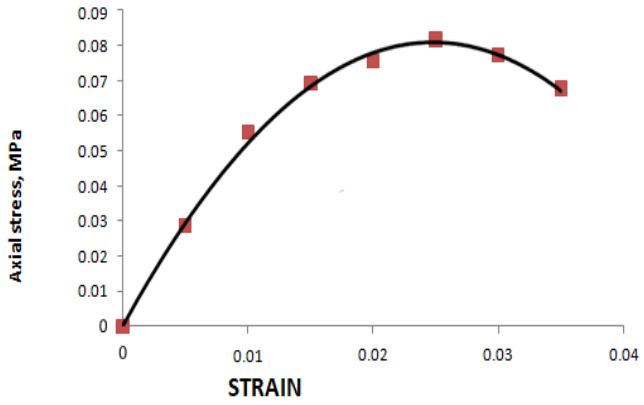


**Figure 15: UCS curve for Soil sample-2**

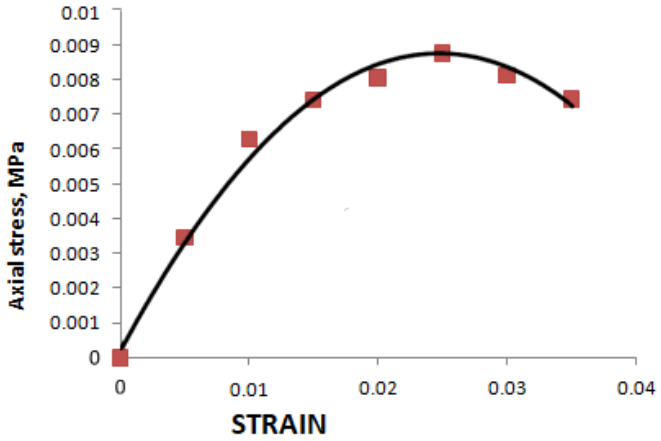


**Figure 16: UCS curve for Soil sample-2 with 10% of CCR and FA mixture**

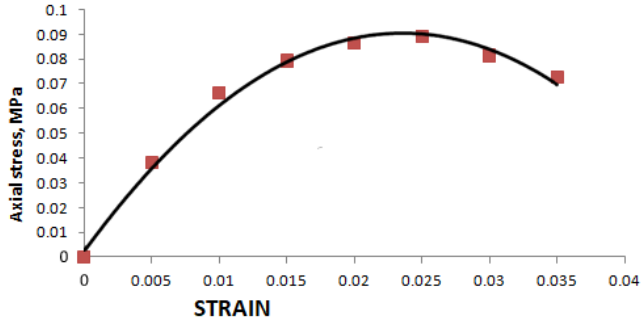


**Figure 17: UCS curve for Soil sample-2 with 15% of CCR and FA mixture**

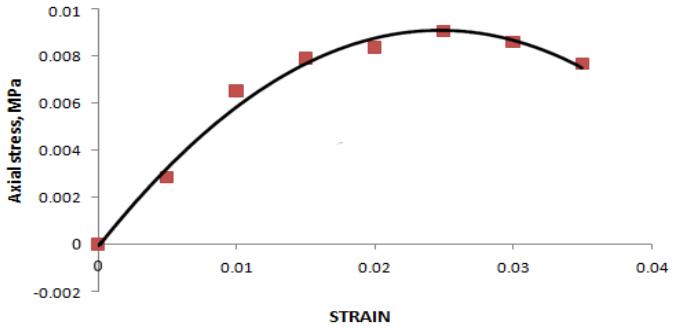


**Figure 18: UCS curve for Soil sample-2 with 20% of CCR and FA mixture**

The unconfined compression value for Soil sample-2 with and without CCR and FA for different proportion of mixture such as 10%, 15% and 20% was 0.081Mpa, 0.087Mpa, 0.089Mpa and 0.090Mpa.

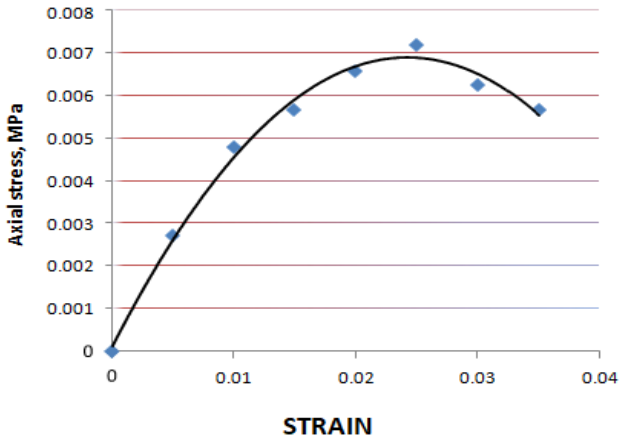


**Figure 19: UCS curve for Soil sample-3**

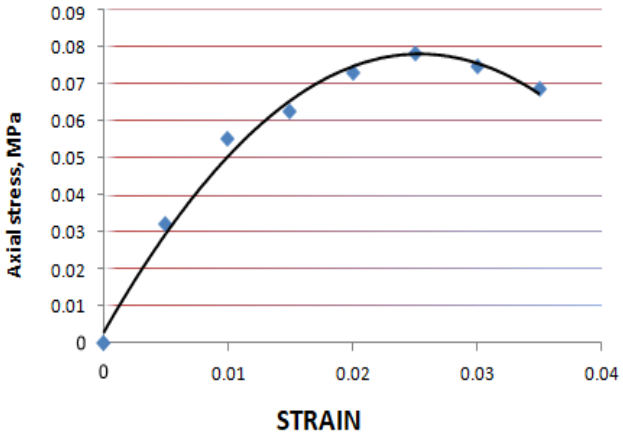


**Figure 20: UCS curve for Soil sample-2 with 10% of CCR and FA mixture**

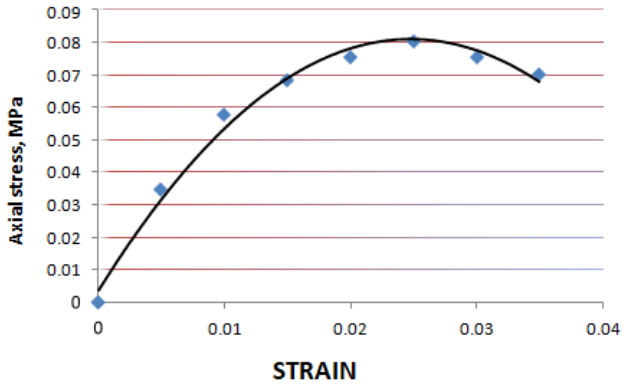


**Figure 21: UCS curve for Soil sample-2 with 15% of CCR and FA mixture**

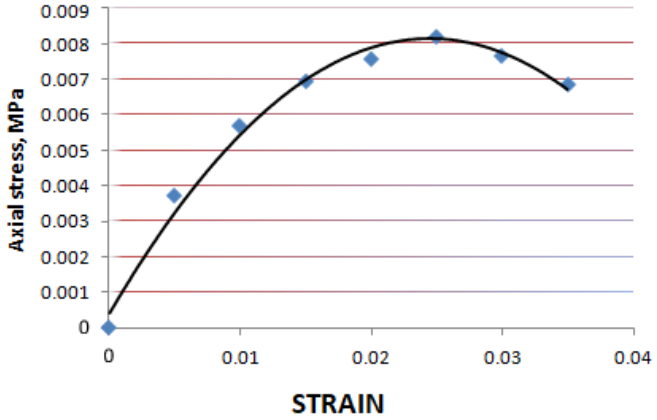


**Figure 22: UCS curve for Soil sample-2 with 20% of CCR and FA mixture**

The unconfined compression value for Soil sample-2 with and without CCR and FA for different proportion of mixture such as 10%, 15% and 20% was 0.069Mpa, 0.078Mpa, 0.080Mpa and 0.085Mpa.

### 3.4 CALIFORNIA BEARING RATIO TEST

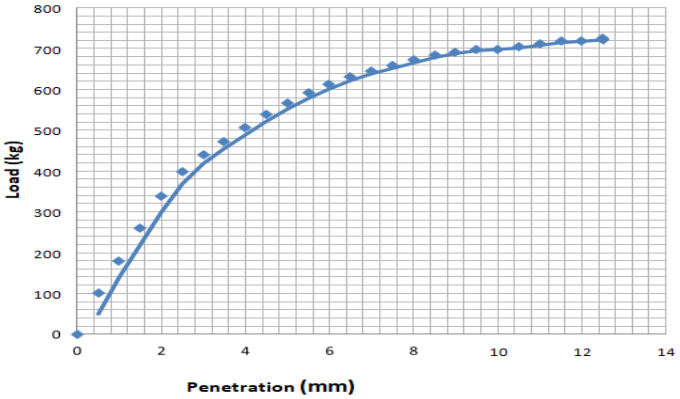


**Figure 23: CBR curve for Soil sample-1**

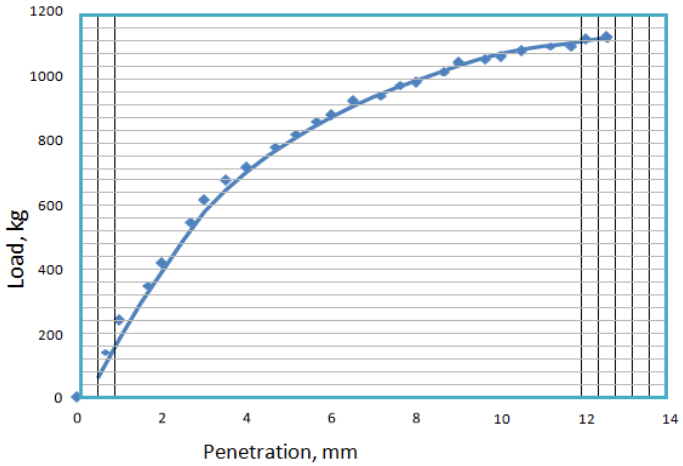


**Figure 24: CBR curve for Soil sample-1 with 10% of CCR and FA mixture**

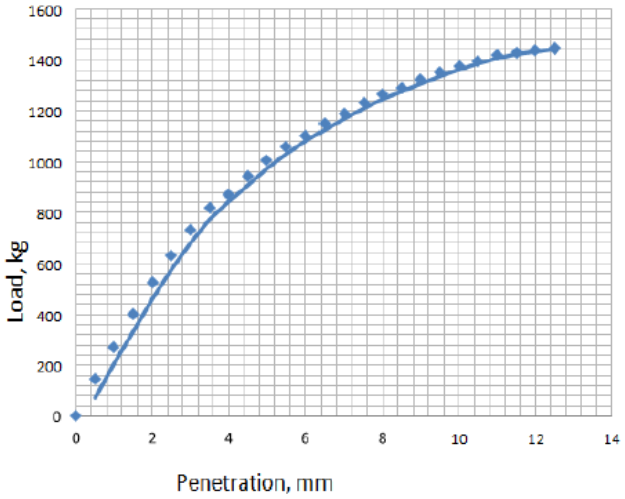


**Figure 25: UCS curve for Soil sample-1 with 15% of CCR and FA mixture**

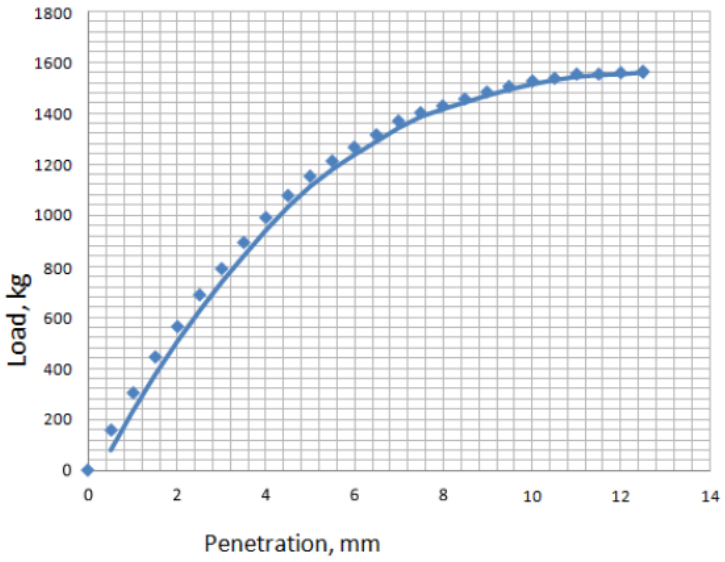


**Figure 26: UCS curve for Soil sample-1 with 20% of CCR and FA mixture**

The California bearing ratio value for Soil sample-2 with and without CCR and FA for different proportion of mixture such as 10%, 15% and 20% was 29%, 39.5%, 46% and 50%.

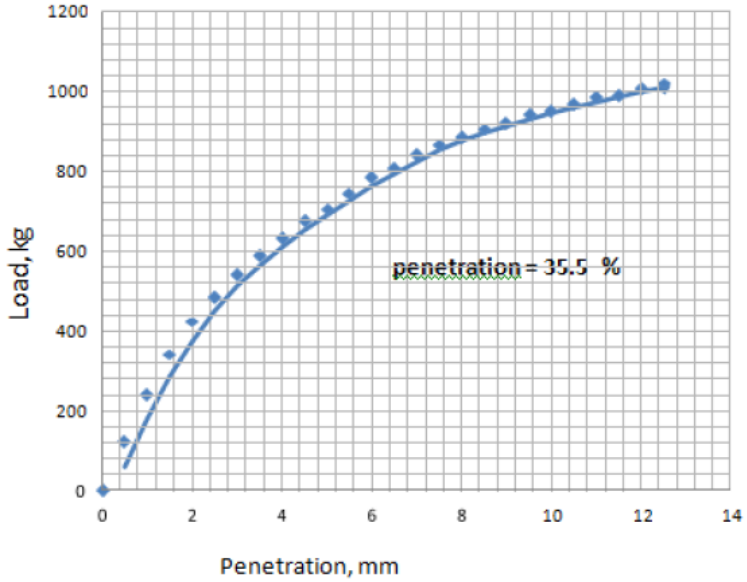


**Figure 27: CBR curve for Soil sample-2**

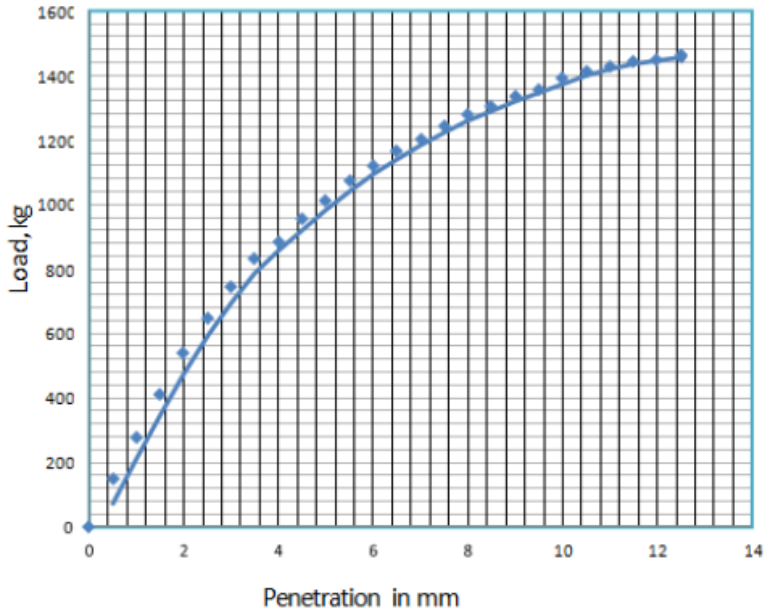


**Figure 28: CBR curve for Soil sample-2 with 10% of CCR and FA mixture**

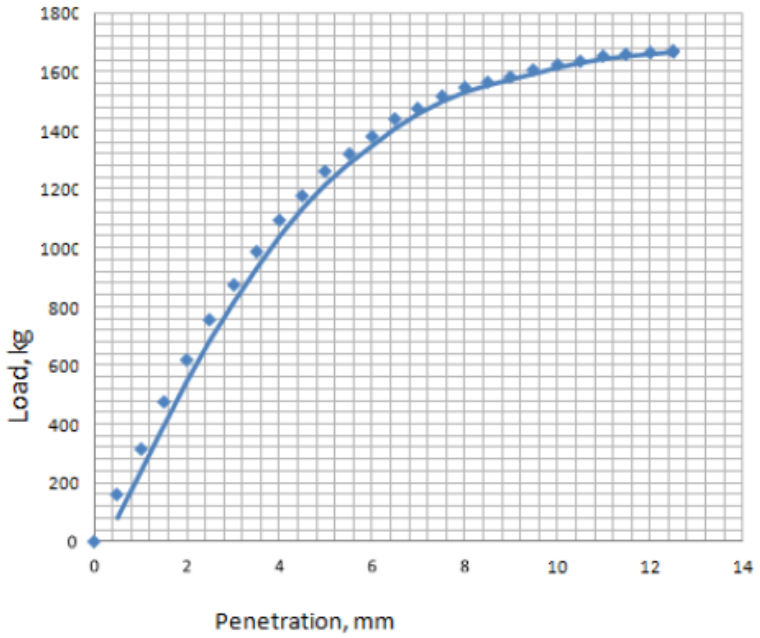


**Figure 29: CBR curve for Soil sample-2 with 15% of CCR and FA mixture**

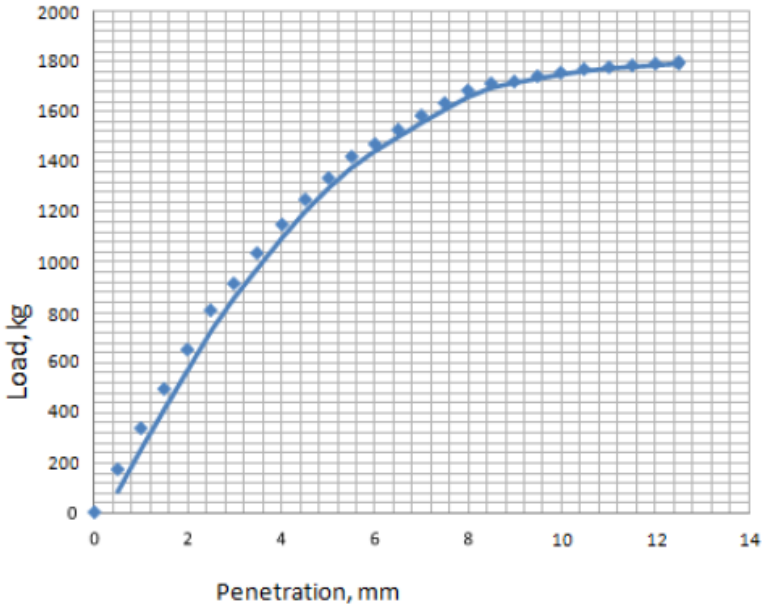


**Figure 30: CBR curve for Soil sample-2 with 20% of CCR and FA mixture**

The California bearing ratio value for Soil sample-2 with and without CCR and FA for different proportion of mixture such as 10%, 15% and 20% was 35.5%, 47%, 54% and 58.5%.

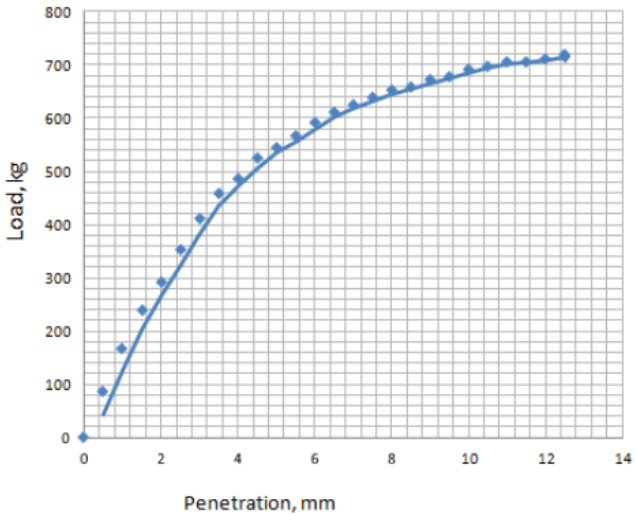


**Figure 31: CBR curve for Soil sample-3**

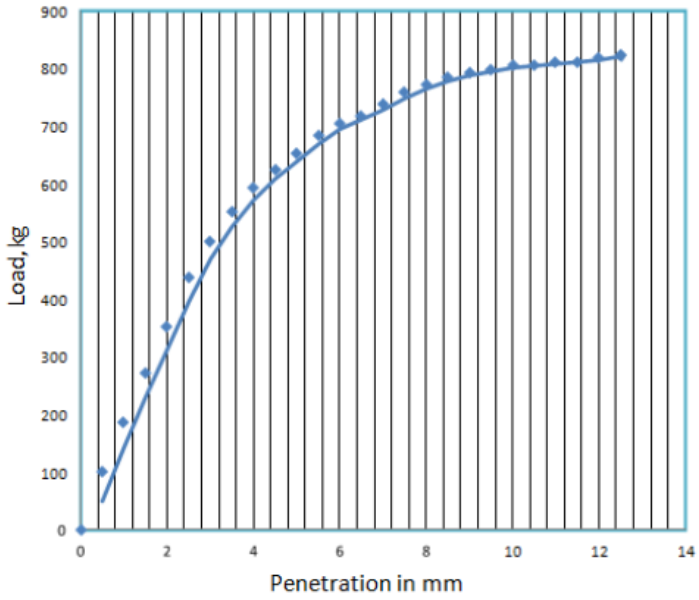


**Figure 32: CBR curve for Soil sample-3 with 10% of CCR and FA mixture**

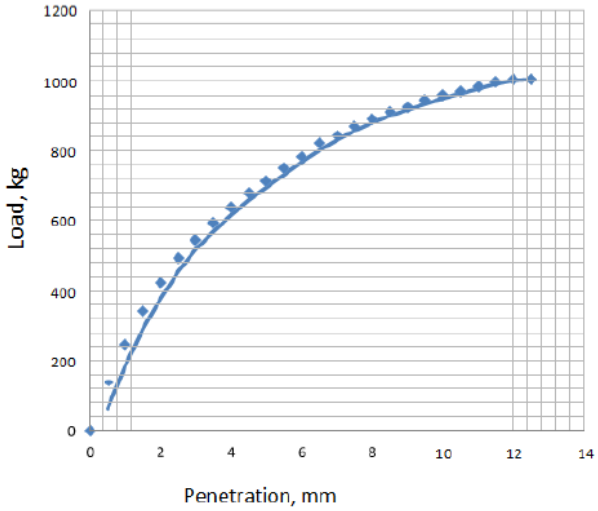


**Figure 33: CBR curve for Soil sample-3 with 15% of CCR and FA mixture**

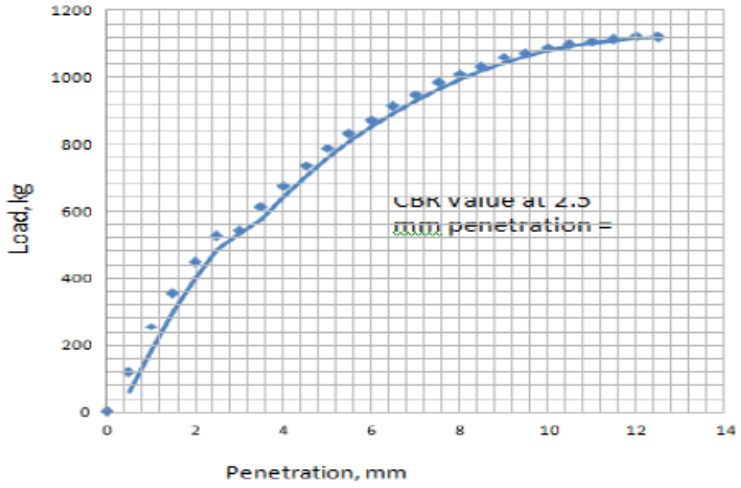


**Figure 34: CBR curve for Soil sample-3 with 20% of CCR and FA mixture**

The California bearing ratio value for Soil sample-2 with and without CCR and FA for different proportion of mixture such as 10%, 15% and 20% was 25.7%, 32%, 36% and 39%.

## III. CONCLUSION

The soil taken from different site present in the same locality has different properties in general. The waste product i.e. Calcium Carbide Residue and Fly Ash can be used to increase the stability of soil. The amount of mixture of CCR and Fly ash added to the soil cannot be generalized but standard increment is observed till mixing 15-20 % of soil weight as further adding increase the strength in very small quantity which is not profitable at all. From all the work we had done so far we can conclude that waste materials Calcium Carbide Residue and Fly Ash mixture can be used to increase the strength of the soil which also decrease the environmental pollution cause by these two.

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MDD of modified soil is maximum at 0.75% coir, which shows an increment of 0.6% and OMC is maximum at 0.25%, which shows an increment of 10%. The triaxial test value of modified soil gets increased with increase in coir content with an increase of 66.66%. The CBR value of modified soil increases with increase in coir content with an increase of 94.8% at 1% coir. MDD increases with increase in percentage of tyre and the OMC gets decreased with increase in percentage of tyre. The use of shredded rubber tyres since reduces the amount of water required for the compaction effort while maintaining a reasonably good maximum dry density. The triaxial test value of modified soil is maximum at 2% tyre, which shows an increment of 44.4%. The CBR value of modified soil is maximum at 8% tyre, which shows an increment of 82.05%. The CBR and triaxial test values of coir at 1% are higher compared to that of tyre. Hence coir is more reliable than tyre.

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