CHAPTER – 4

EXPERIMENTAL WORK

The experiments have been conducted by mixing polypropylene fibers with Pond Ash in amounts 0.5%, 1%, 1.5% and 2% by weight. The specifications of the material are given below:

MATERIAL DESCRIPTION

POLYPROPYLENE FIBERS:

Fibermesh Fibercast micro-reinforcement systems for Portland cement plastering – 100 percent virgin homo polymer polypropylene fibers containing no reprocessed olefin material and specifically engineered and manufactured in an ISO 9001 : 2000 certified facility and complies with ASTM C- 1116 and ACI 524R.

PHYSICAL AND CHEMICAL PROPERTIES

1)	ABSORPTION	-	NIL
2)	FIBRE LENGTH	-	1/4 "
3)	MELT POINT	-	324^0 F
4)	THERMAL CONDUCTIVITY	-	LOW
5)	ACID AND SALT RESISTANCE	-	HIGH
6)	SPECIFIC GRAVITY	-	0.91
7)	YOUNG'S MODULUS	-	3.5 kN/mm^2
8)	IGNITION POINT	-	$1{,}100^0$ F
9)	ELECTRICAL CONDUCTIVITY	-	LOW
10)	ALKALI RESISTANCE	-	ALKALI PROOF

POND ASH:

The pond ash was obtained from Rajghat thermal power station, New Delhi.

Pic. 4 – Wet disposal of pond ash from Rajghat Power Station

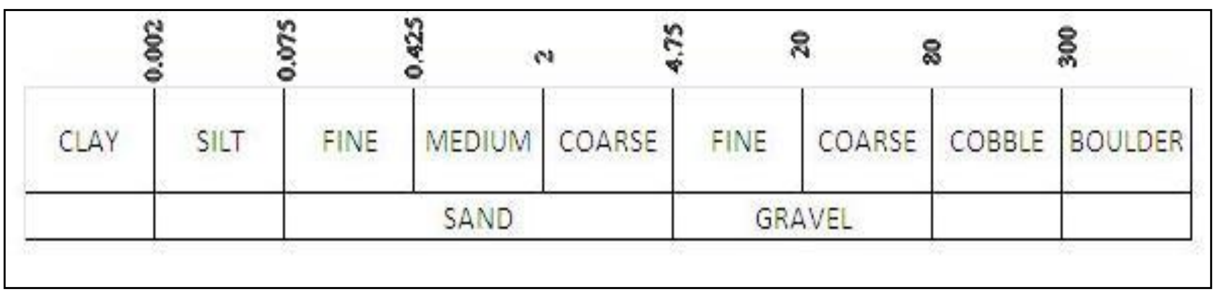
Pic. 5 – Ash pond at Rajghat

GRAIN SIZE ANALYSIS

The grain size analysis is widely used in classification of soils. The grain size analysis is an attempt to determine the relative proportions of different grain sizes which make up a given soil mass. The data obtained from grain size distribution curves is used in the design of filters for earth dams and to determine suitability of soil for road construction, air field etc. Information obtained from grain size analysis can be used to predict soil water movement although permeability tests are more generally used.

The soil is generally divided in to four parts based on particle size the fraction of soil grater than 2mm size is called gravel, that between 2 mm and 0.06 mm is sand, between 0.06and 0.002 mm is silt and smaller than 0.002 mm is clay.

The test is conducted on the basis of IS 2720(part 4).



Pic. 6 – Indian Standard Code Specifications

Pic. 7 – Sieve Arrangement for Grain Size Analysis

CALCULATION

1. The percentage of soil retained on each sieve shall be calculated on the basis of total weight of soil sample retained in sieve.
2. Cumulative percentage of soil retained on successive sieve is found

Note: No particle of soil sample shall be pushed through the sieves

RESULTS OF GRAIN SIZE ANALYSIS:

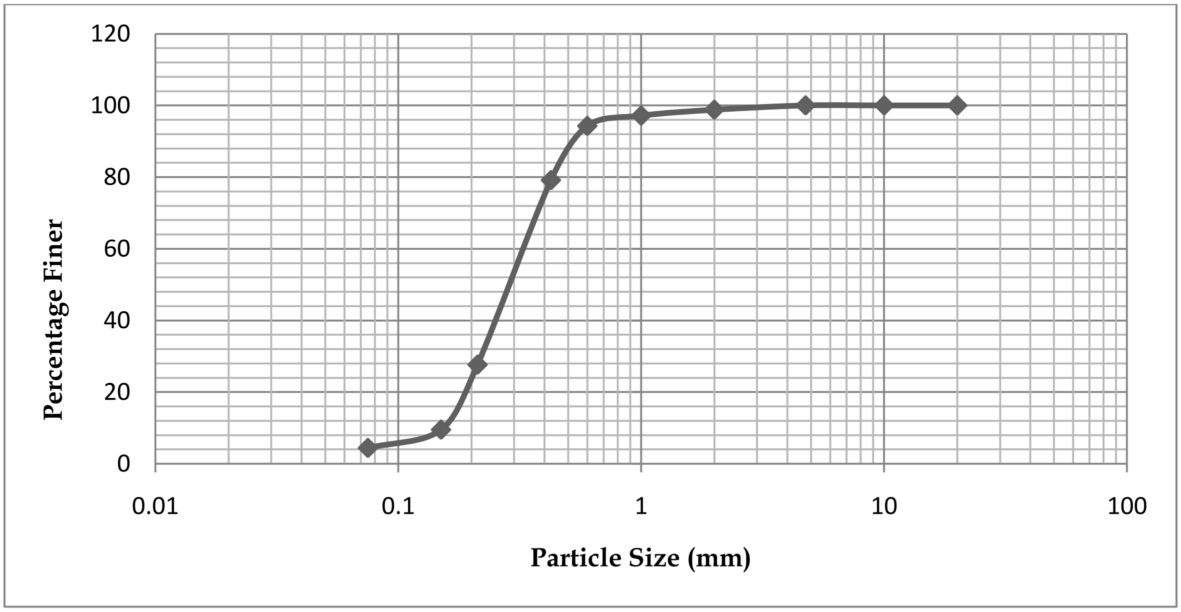


Fig. 1 – Plot between Particle size and percent finer

Table 3 - Grain Size Analysis of Pond Ash

Parameters	
D_{60}	0.346
D_{10}	0.152
D_{30}	0.222
C_u	2.275
C_c	0.937

SPECIFIC GRAVITY TEST

Specific gravity (G) is defined as the ratio of the weight of an equal volume of distilled water at that temperature both weights taken in air. The specific gravity found by pycnometer having volume of 0.9 litres.

$$\text{Specific Gravity of a material} = \frac{\text{Density of material}}{\text{Density of water}}$$

$$\text{Specific Gravity of material} = \frac{W2 - W1}{(W2 - W1) - (W3 - W4)}$$

The test is conducted on the basis of IS 2720(part 3).

Pic. 8 – Pycnometer with water and sample

Pic. 9 – Pycnometer with water

RESULT OF SPECIFIC GRAVITY TEST

The Specific Gravity of material, as per IS 2720(part 3), was found to be 2.42

STANDARD PROCTOR TEST

This method covers the determination of the relationship between the moisture content and density of soils compacted in a mould of a given size with a 2.5 kg rammer dropped from a height of 30 cm.

The compaction of soil by rolling etc. is best performed if we add certain amount of water during compaction less than or more than that quantity of water will not help us to achieve maximum compaction or Maximum Dry Density (MDD) of compacted soil. The most beneficial water content is known as Optimum moisture Content (OMC).

CALCULATION

Wet density (gm/cm^3) = weight of compacted soil / 944.

Dry density (gm/cm^3) = wet density/ (1+w)

Where, w is the moisture content of the soil.

Plot the dry density against moisture content and find out the maximum dry density and optimum moisture for the soil.

Pic. 10 - Standard Proctor Test Apparatus

Pic. 11 – Weighing of sample to find moisture content

STANDARD PROCTOR TEST RESULTS:

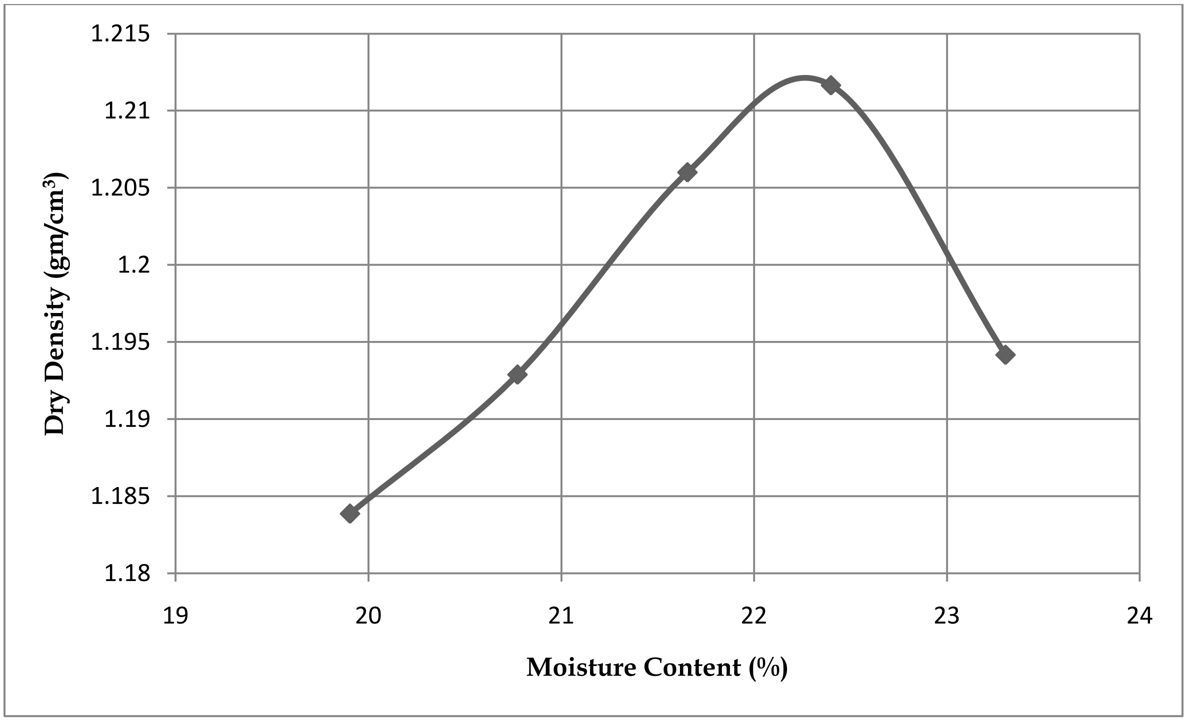


Fig. 2 – Plot between Moisture Content and Dry Density for Pond Ash with 0 % Polypropylene Fibers

Table 4 - Pond Ash with 0 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
22.3990	1.2117

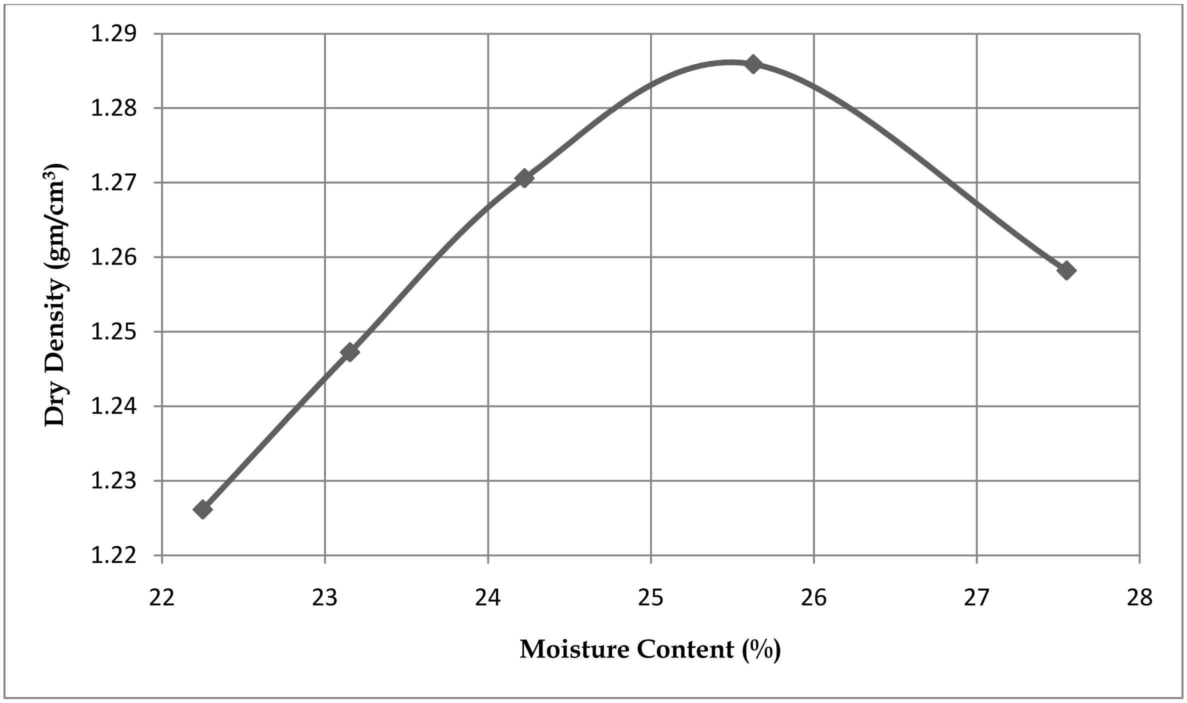


Fig. 3 – Plot between Moisture Content and Dry Density for Pond Ash with 0.5 % Polypropylene Fibers

Table 5 - Pond Ash with 0.5 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
25.6281	1.2859

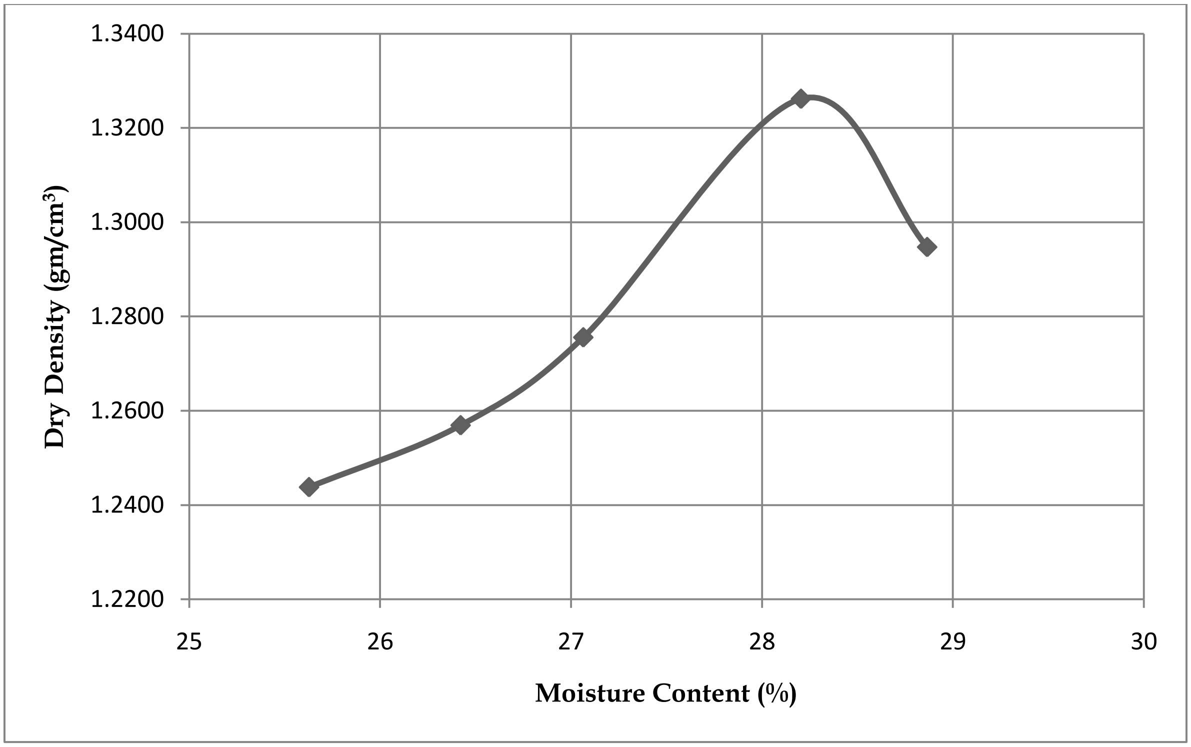


Fig. 4 – Plot between Moisture Content and Dry Density for Pond Ash with 1.0 % Polypropylene Fibers

Table 6 - Pond Ash with 1.0 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
28.2051	1.3262

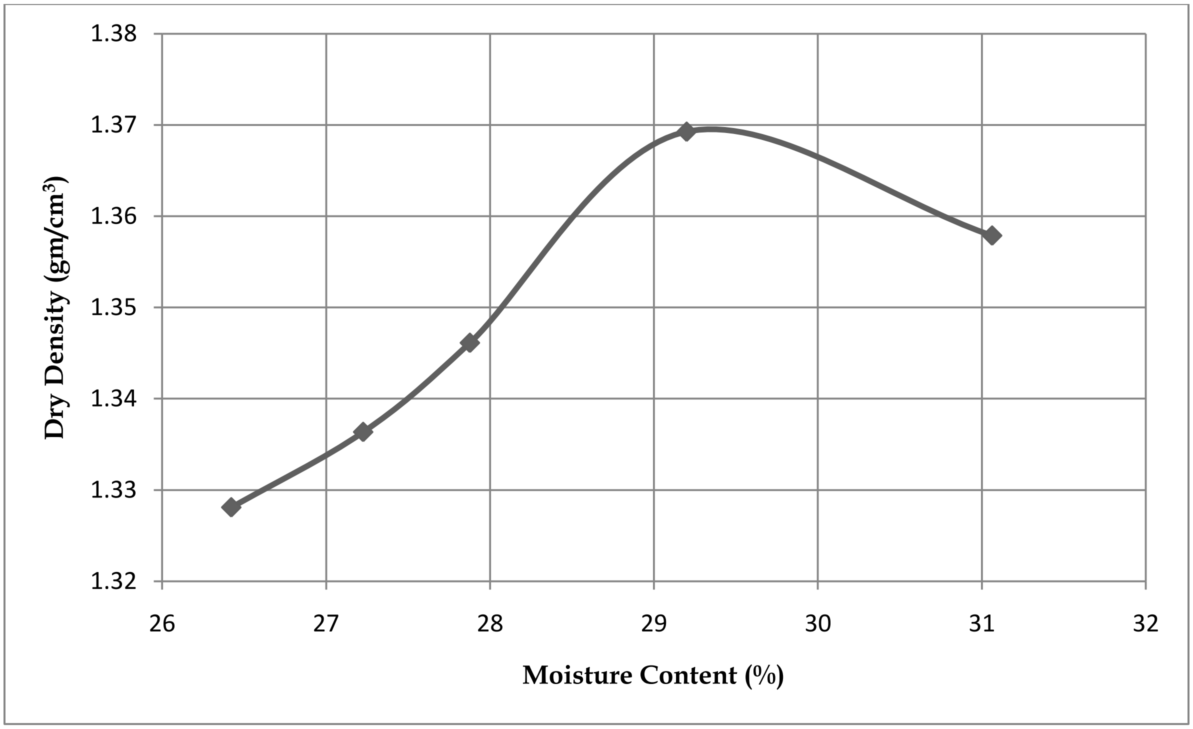


Fig. 5 – Plot between Moisture Content and Dry Density for Pond Ash with 1.5 % Polypropylene Fibers

Table 7 - Pond Ash with 1.5 % Polypropylene Fibers

OMC (%)	MDD (gm/cm³)
29.1990	1.3693

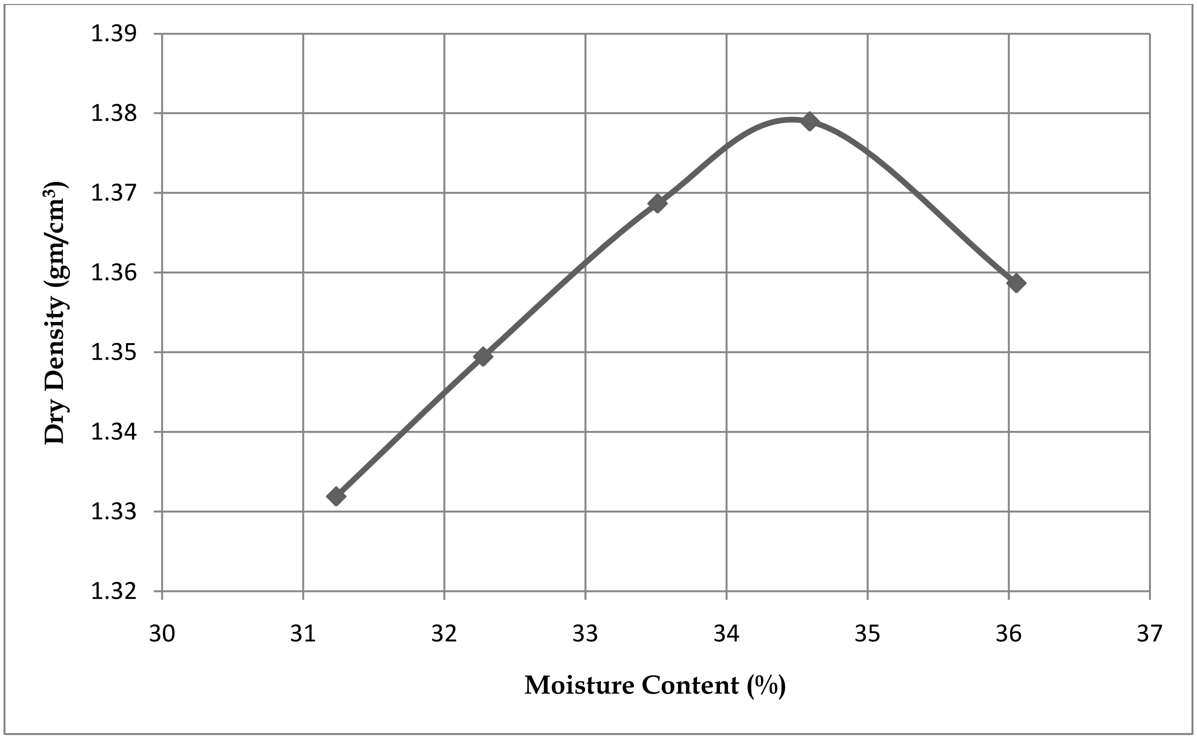


Fig. 6 – Plot between Moisture Content and Dry Density for Pond Ash with 2.0 % Polypropylene Fibers

Table 8 - Pond Ash with 2.0 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
34.5895	1.3790

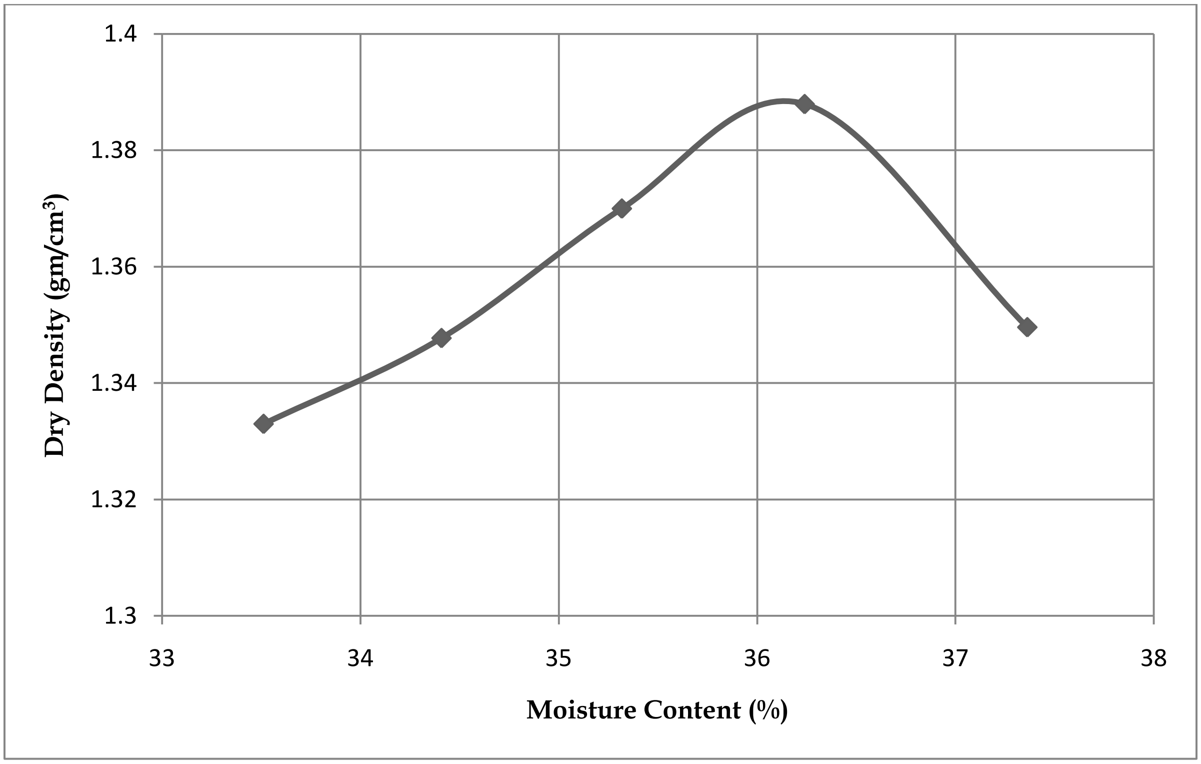


Fig. 7 – Plot between Moisture Content and Dry Density for Pond Ash with 2.5 % Polypropylene Fibers

Table 9 - Pond Ash with 2.5 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
36.2398	1.3879

MODIFIED PROCTOR TEST

This method covers the determination of the relationship between the moisture content and density of soils compacted in a mould of a given size with a 4.89 kg rammer dropped from a height of 44.5 cm.

The graph between moisture content and dry density generally shifts to left side and higher when compared to standard proctor tests as higher compaction is achieved. The compactive effort in modified proctor test is about 27 times that in standard proctor test.

CALCULATION

Wet density (gm/cm^3) = weight of compacted soil / 944.

Dry density (gm/cm^3) = wet density/ (1+w)

Where, w is the moisture content of the soil.

Plot the dry density against moisture content and find out the maximum dry density and optimum moisture for the soil.

Pic. 12 – Modified Proctor Test Apparatus

Pic. 13 – Weight measurement of MPT samples

MODIFIED PROCTOR TEST RESULTS

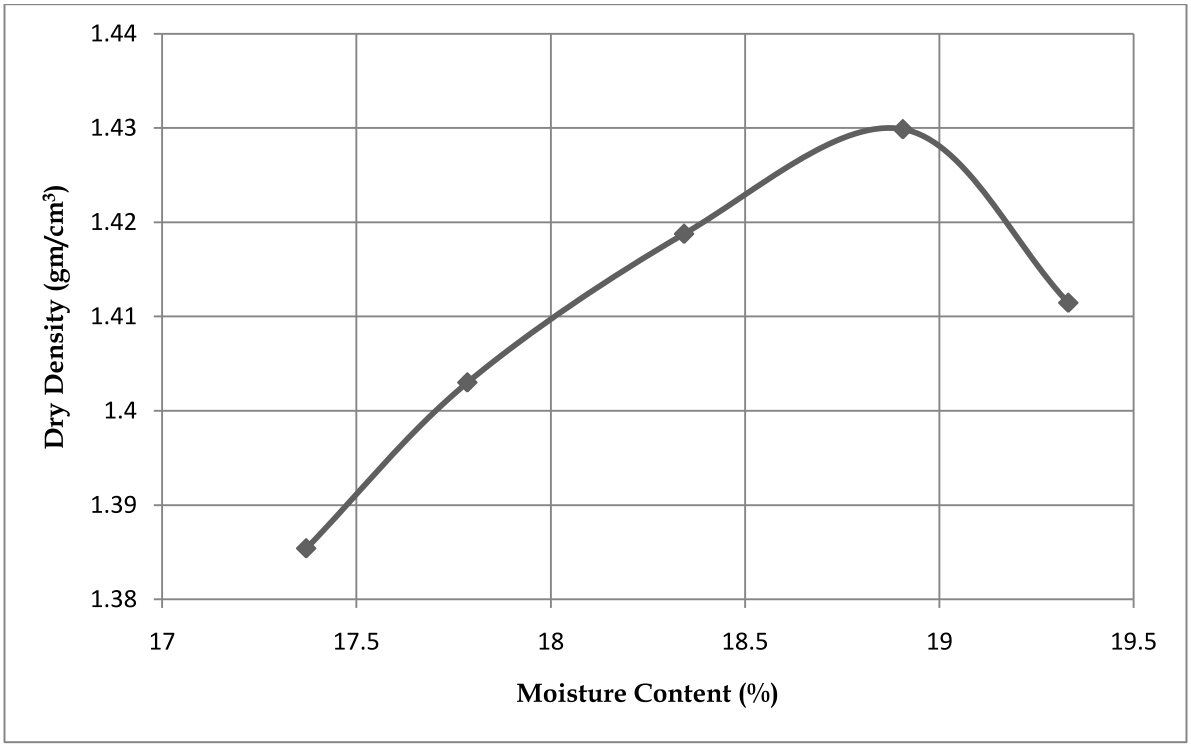


Fig. 8 – Plot between Moisture Content and Dry Density for Pond Ash with 0 % Polypropylene Fibers

Table 10 - Pond Ash with 0 % Polypropylene Fibers

OMC (%)	MDD (gm/cm³)
18.9061	**1.4299**

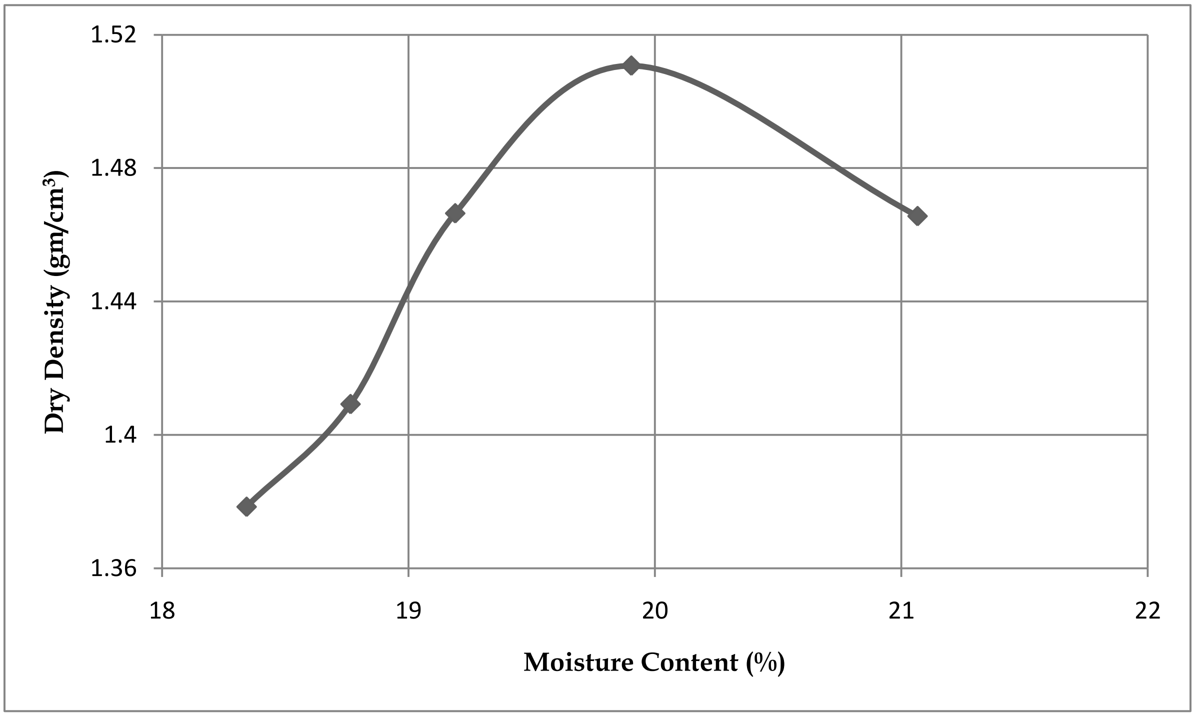


Fig. 9 – Plot between Moisture Content and Dry Density for Pond Ash with 0.5 % Polypropylene Fibers

Table 11 - Pond Ash with 0.5 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
19.9041	1.5107

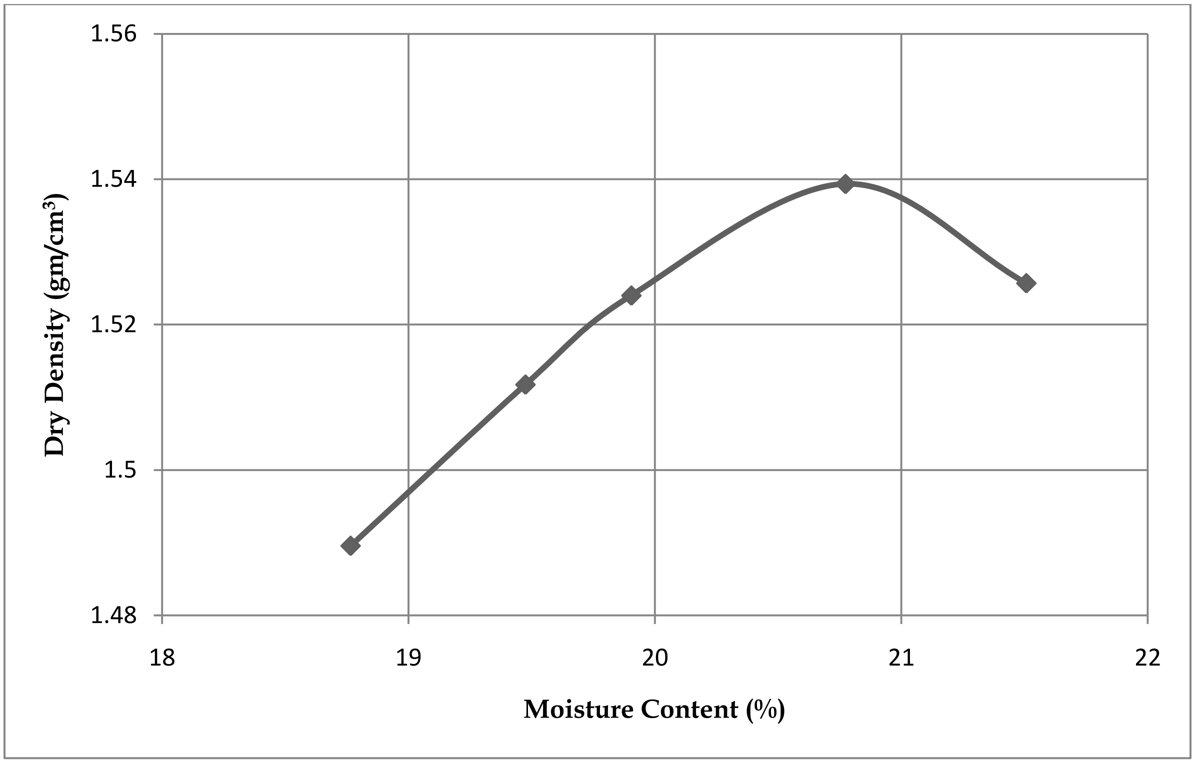


Fig. 10 – Plot between Moisture Content and Dry Density for Pond Ash with 1.0 % Polypropylene Fibers

Table 12 - Pond Ash with 1.0 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
20.7729	1.5393

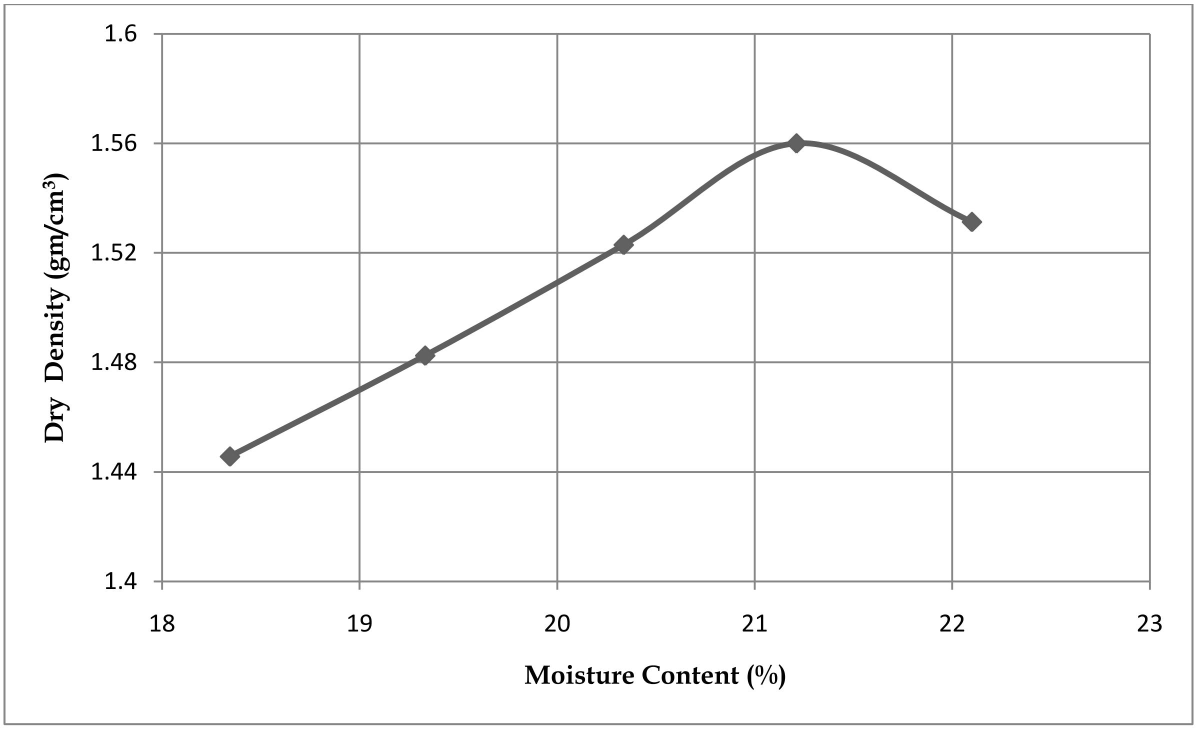


Fig. 11 – Plot between Moisture Content and Dry Density for Pond Ash with 1.5 % Polypropylene Fibers

Table 13 - Pond Ash with 1.5 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
21.2121	1.5600

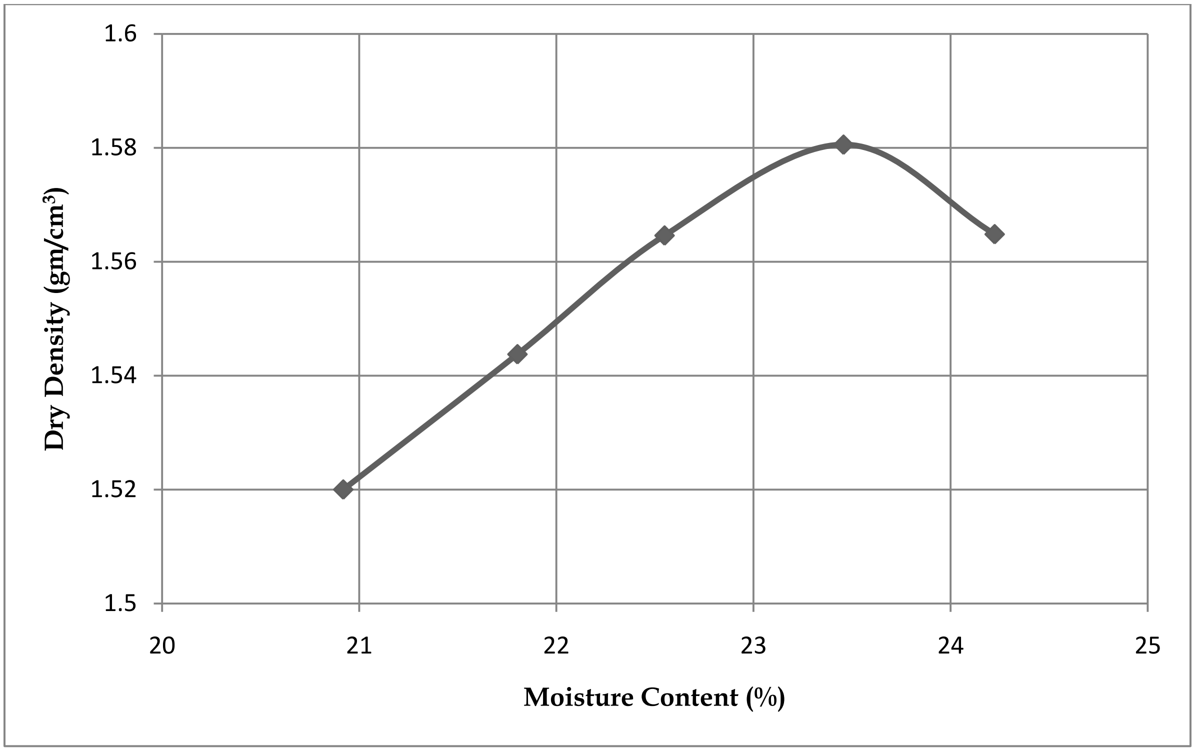


Fig. 12 – Plot between Moisture Content and Dry Density for Pond Ash with 2.0 % Polypropylene Fibers

Table 14 - Pond Ash with 2.0 % Polypropylene Fibers

OMC (%)	MDD (gm/cm³)
23.4568	**1.5805**

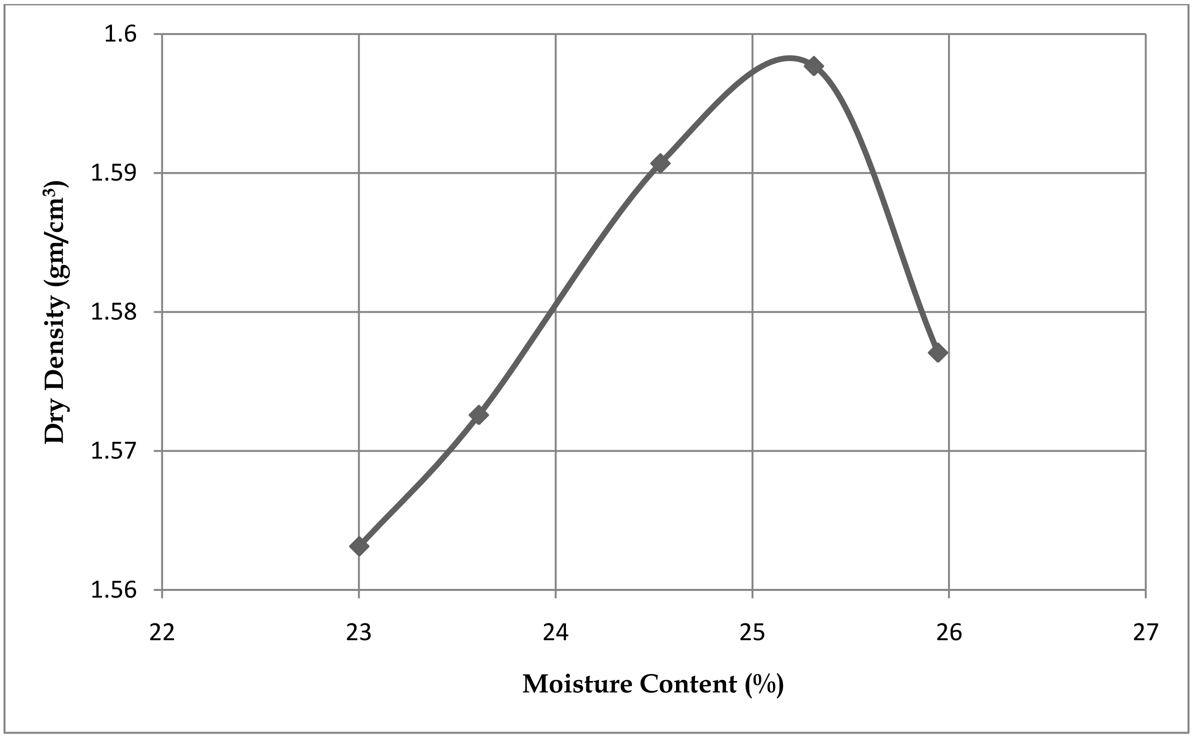


Fig. 13 – Plot between Moisture Content and Dry Density for Pond Ash with 2.5 % Polypropylene Fibers

Table 15 - Pond Ash with 2.5 % Polypropylene Fibers

OMC (%)	MDD (gm/cm^3)
25.3133	**1.5977**

CALIFORNIA BEARING RATIO TEST

This is penetration test developed by the California Division of Highway as a method for evaluating the stability of soil sub-grade and other flexible pavements material .The test results are correlated with flexible pavements thickness required for highway and air fields.

The results obtained by these tests are used with the empirical curves to determine the thickness of pavement and its component layers. This is the most widely used method for the design of flexible pavement.

CALCULATION

It is the ratio of force per unit area required to penetrate a soil mass with standard circular piston at the rate of 1.25 mm/min. to that required for the corresponding penetration of a standard material. The following table gives the standard loads adopted for different penetrations for the standard material with a C.B.R. value of 100%

Table 16 – Standard Load values for CBR Test

Penetration of plunger in mm	Standard load in Kg
2.5	1370
5	2055
7.5	3180
12	3600

OBSERVATION AND READING

Least count of penetration dial- 1 Division = 0.01 mm

If the initial portion of the curve is concave upwards, apply correction by drawing a tangent to the curve at the point of greatest slope and shift the origin Find and record the correct load reading corresponding to each penetration.

$$C.B.R. = (P_T/P_S)\ 100$$

Where,

P_T = Corrected test load corresponding to the chosen penetration from the load penetration curve.

P_S = Standard load for the same penetration taken from the table.

INTERPRETATION AND RECORDING

C.B.R. of specimen at 2.5 mm penetration

C.B.R. of specimen at 5.0 mm penetration

The C.B.R. values are usually calculated for penetration of 2.5 mm and 5 mm. Generally the C.B.R. value at 2.5 mm will be greater that at 5 mm and in such a case/the former shall be taken as C.B.R. for design purpose. If C.B.R. for 5 mm exceeds that for 2.5 mm, the test should be repeated. If identical results follow, the C.B.R. corresponding to 5 mm penetration should be taken for design.

Pic. 14 – California Bearing Ratio Test Machine

Pic. 15 – CBR Test setup

Pic. 16 – Imprint of Plunger on the sample after the test

CALIFORNIA BEARING RATIO (UNSOAKED) TEST RESULTS

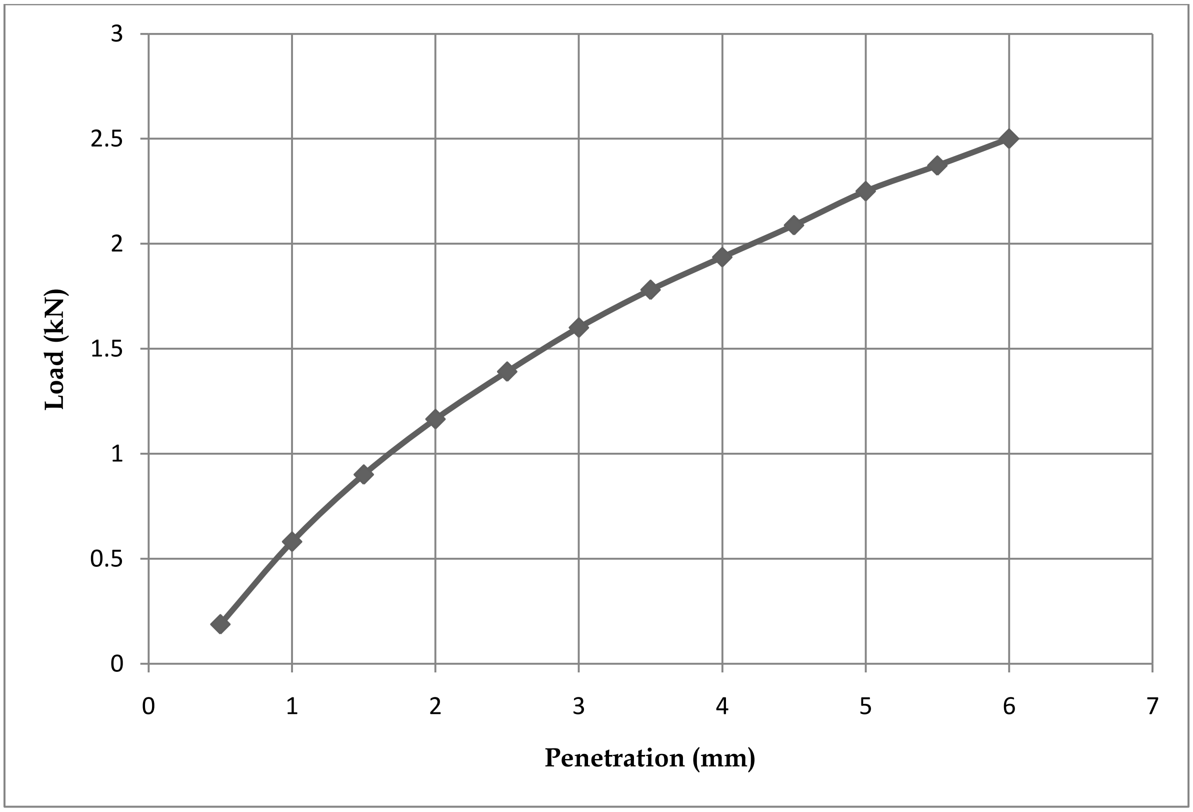


Fig. 14 – Plot between Penetration and Load for Pond Ash with 0 % Polypropylene Fibers

Table 17 - Pond Ash with 0 % Polypropylene Fibers

CBR Value	**11.16**

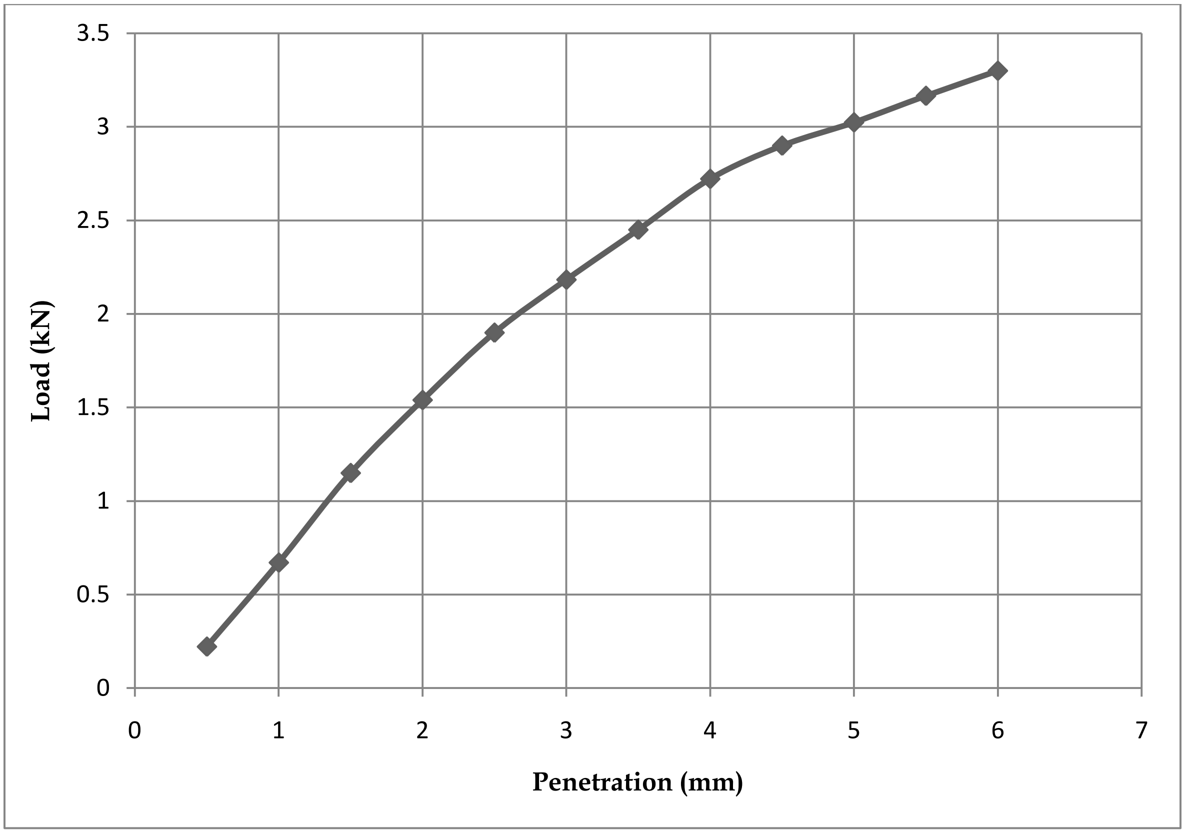


Fig. 15 – Plot between Penetration and Load for Pond Ash with 0.5 % Polypropylene Fibers

Table 18 - Pond Ash with 0 % Polypropylene Fibers

CBR Value	**15**

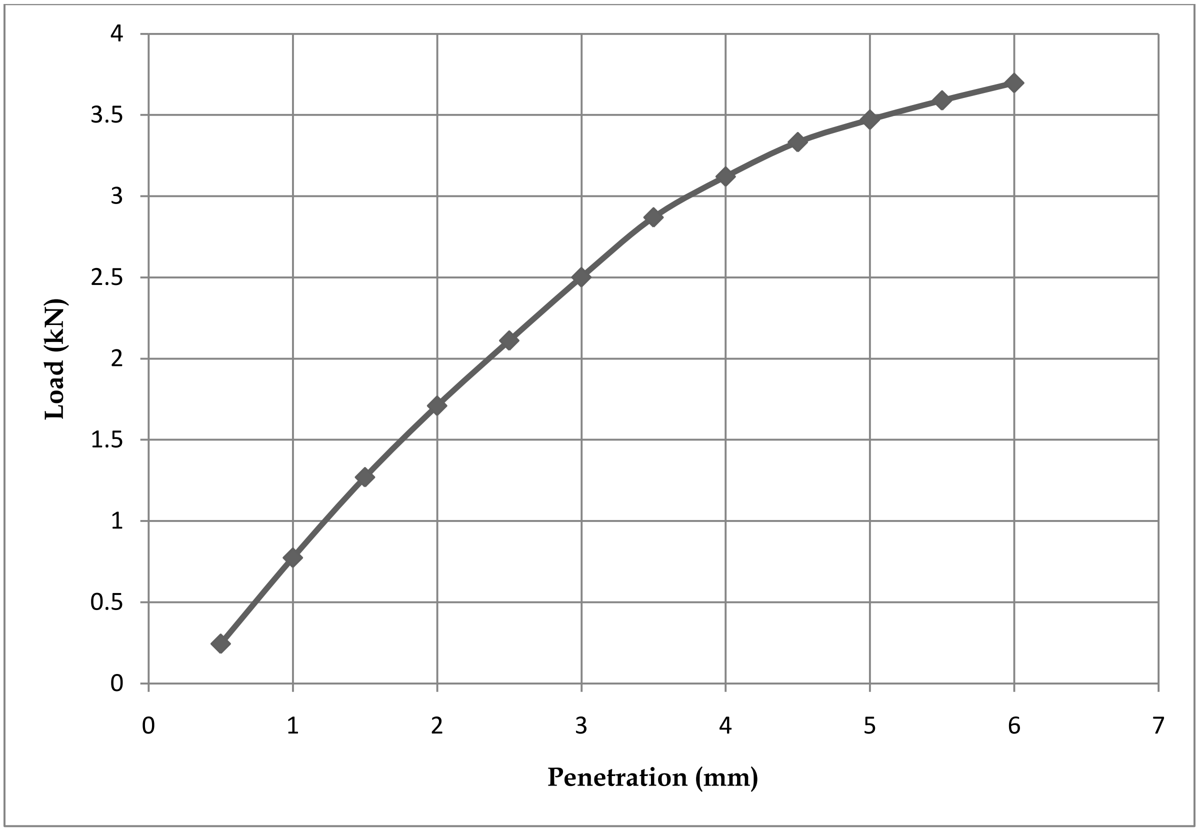


Fig. 16 – Plot between Penetration and Load for Pond Ash with 1.0 % Polypropylene Fibers

Table 19 - Pond Ash with 1.0 % Polypropylene Fibers

CBR Value	**17.22**

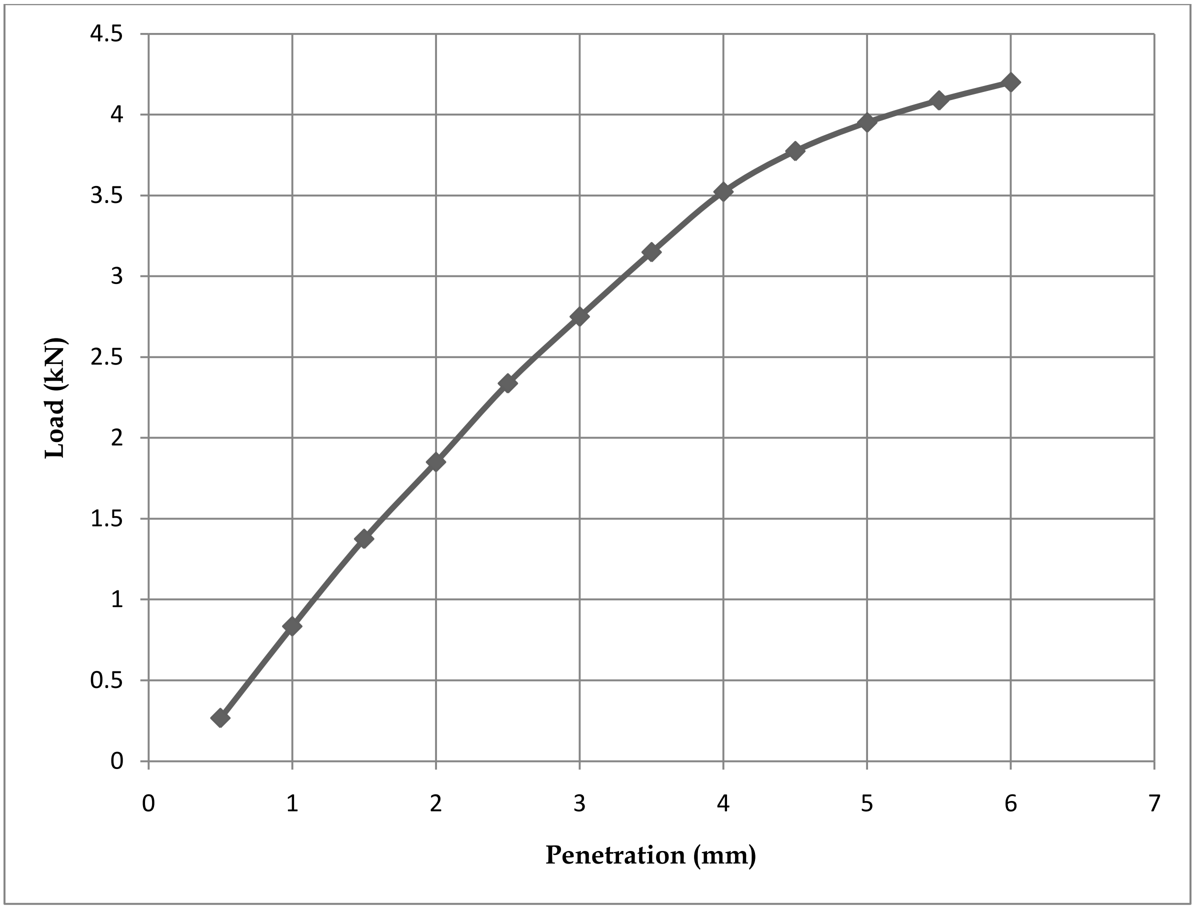


Fig. 17 – Plot between Penetration and Load for Pond Ash with 1.5 % Polypropylene Fibers

Table 20 - Pond Ash with 1.5 % Polypropylene Fibers

CBR Value	**19.60**

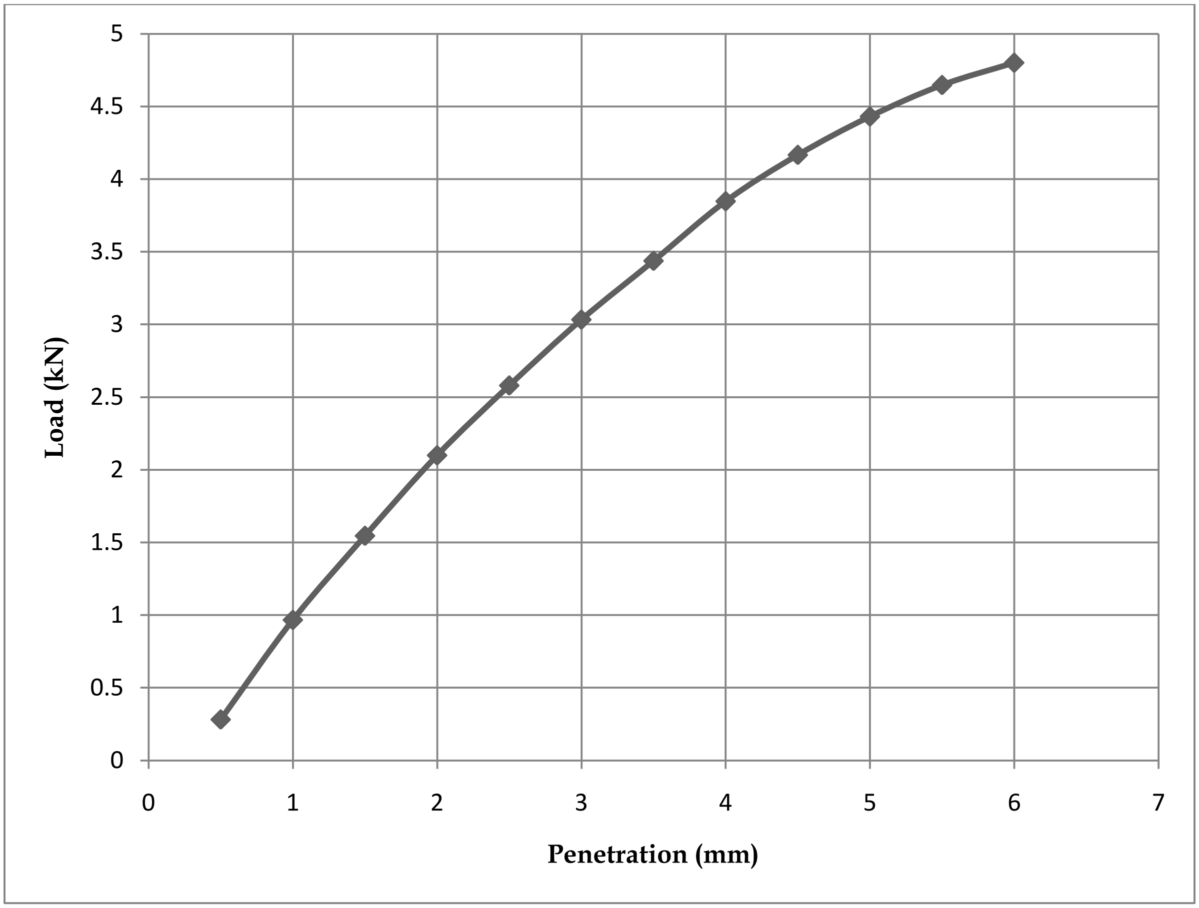


Fig. 18 – Plot between Penetration and Load for Pond Ash with 2.0 % Polypropylene Fibers

Table 21 - Pond Ash with 2.0 % Polypropylene Fibers

CBR Value	**21.98**

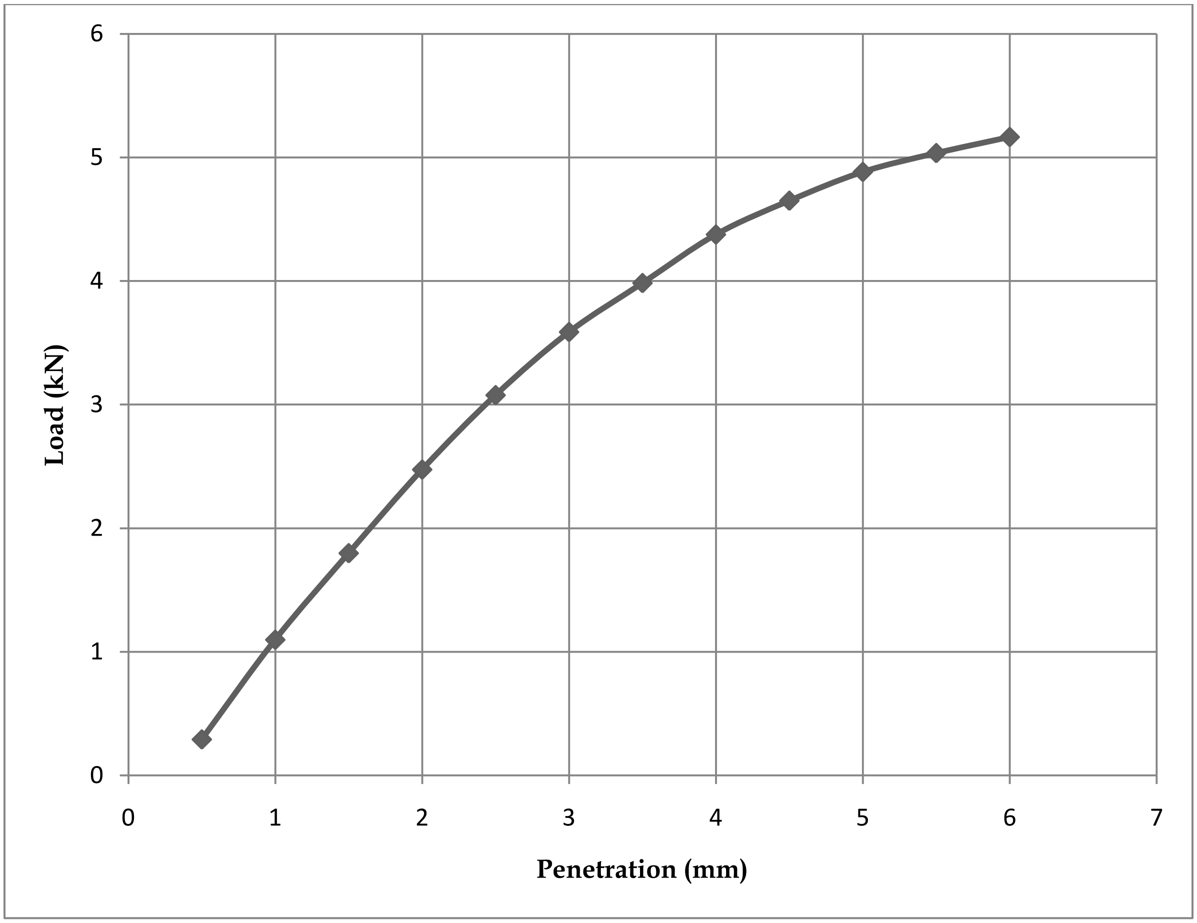


Fig. 19 – Plot between Penetration and Load for Pond Ash with 2.5 % Polypropylene Fibers

Table 22 - Pond Ash with 2.5 % Polypropylene Fibers

CBR Value	**24.22**

CALIFORNIA BEARING RATIO (SOAKED) RESULTS

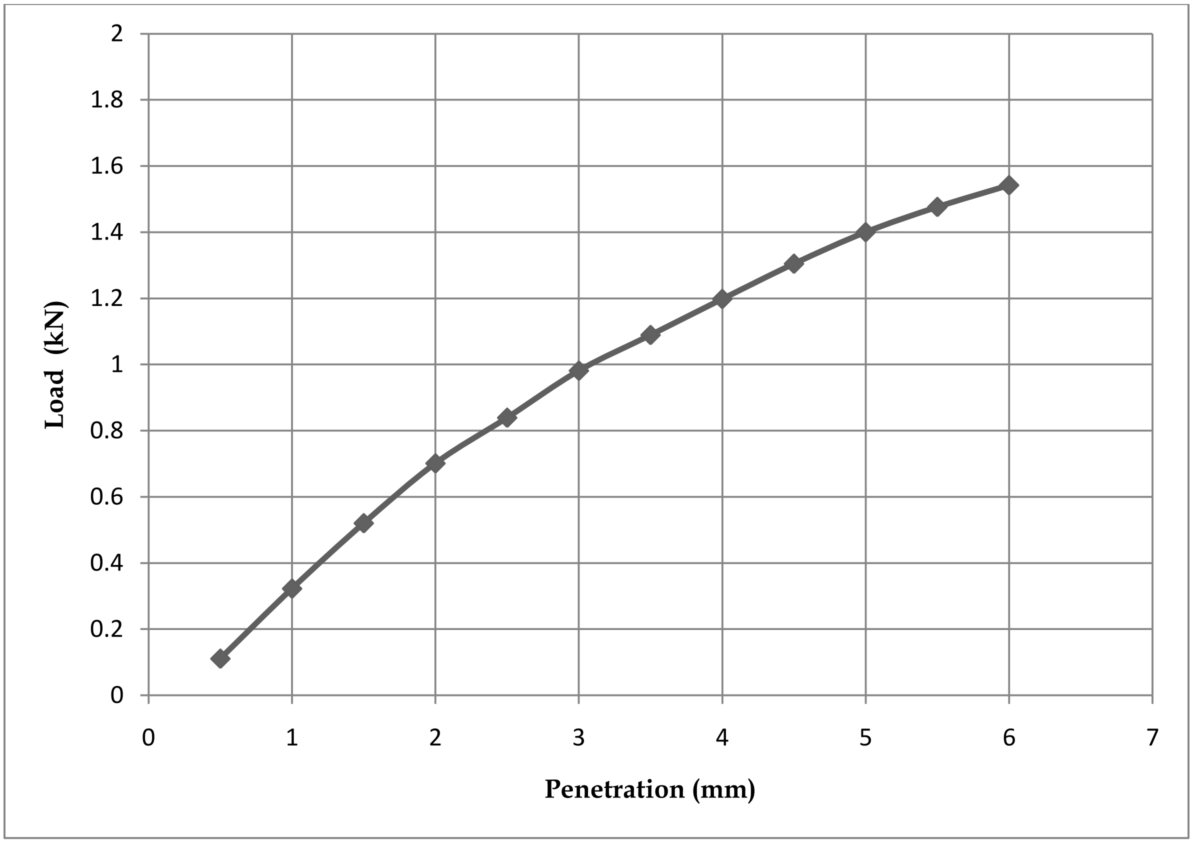


Fig. 20 – Plot between Penetration and Load for Pond Ash with 0 % Polypropylene Fibers

Table 23 - Pond Ash with 0 % Polypropylene Fibers

CBR Value	**6.94**

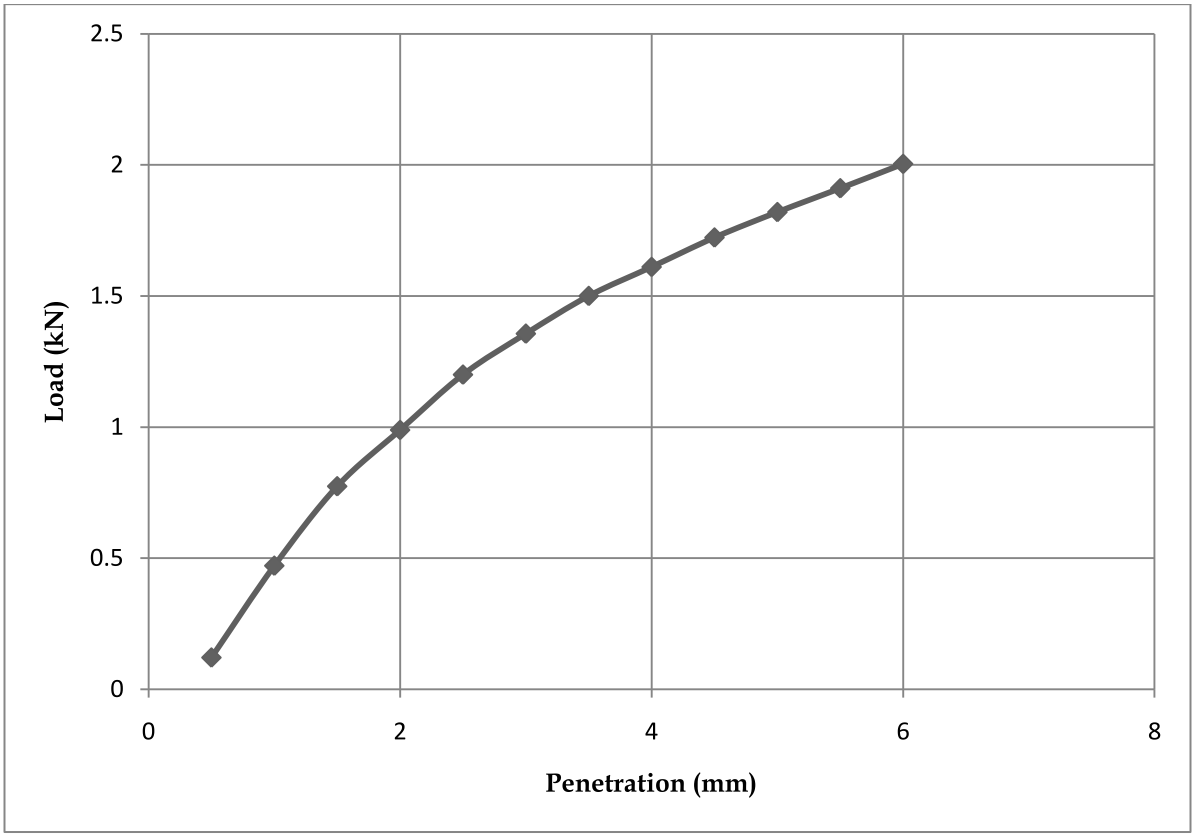


Fig. 21 – Plot between Penetration and Load for Pond Ash with 0.5 % Polypropylene Fibers

Table 24 - Pond Ash with 0.5 % Polypropylene Fibers

CBR Value	**9.02**

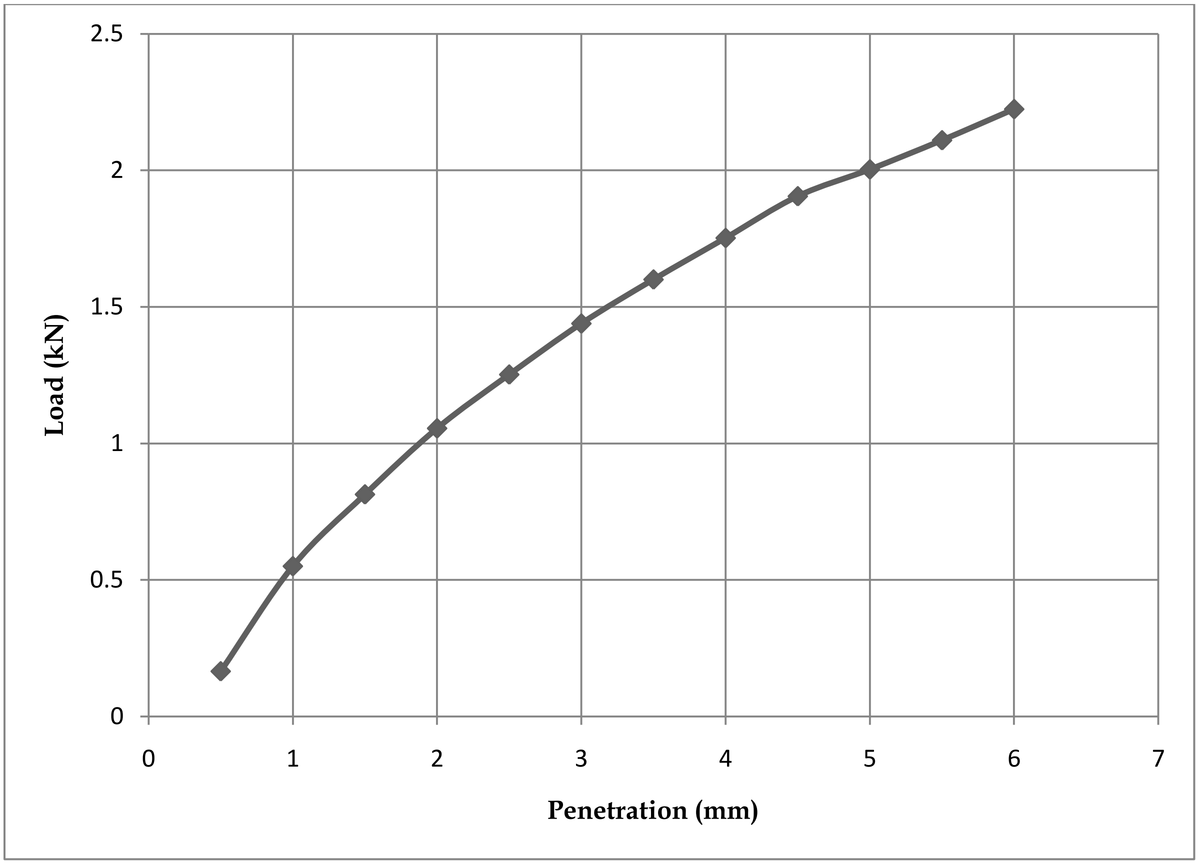


Fig. 22 – Plot between Penetration and Load for Pond Ash with 1.0 % Polypropylene Fibers

Table 25 - Pond Ash with 1.0 % Polypropylene Fibers

CBR Value	**9.94**

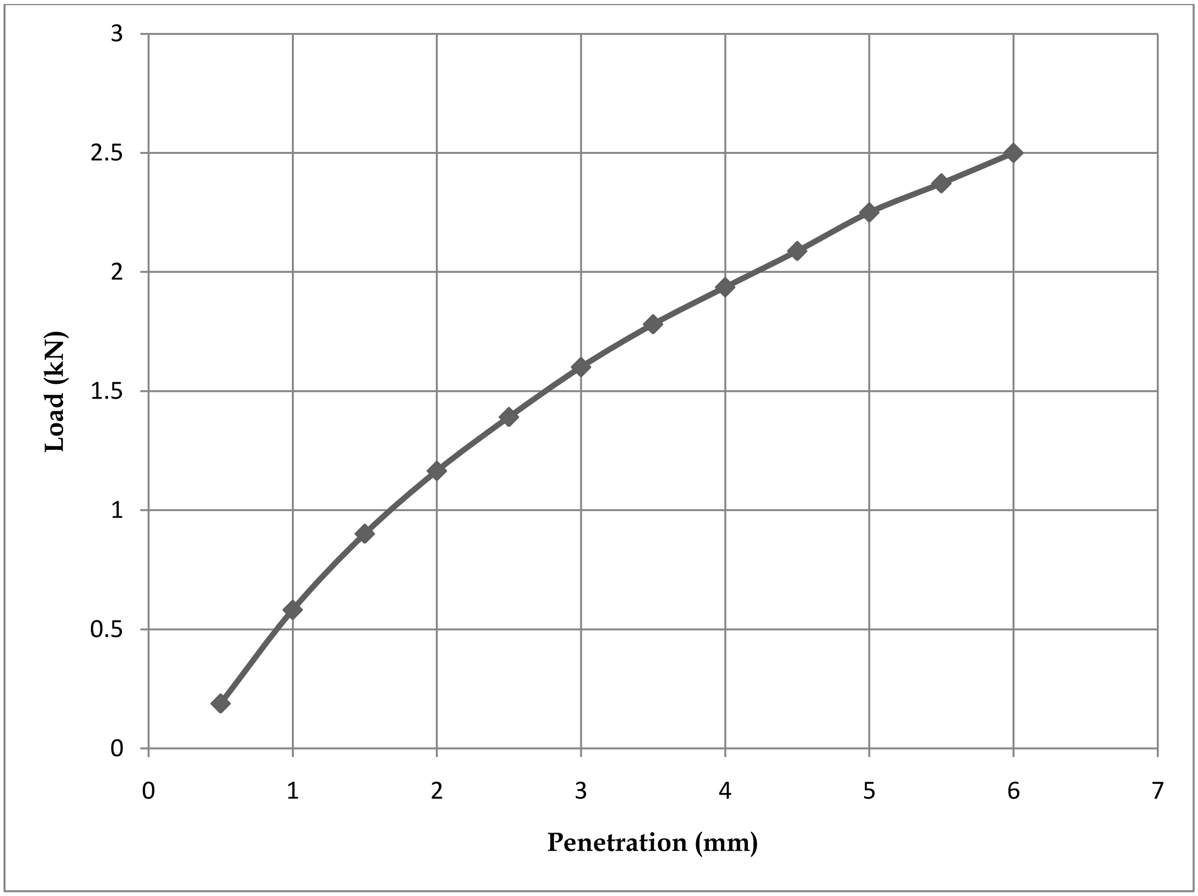


Fig. 23 – Plot between Penetration and Load for Pond Ash with 1.5 % Polypropylene Fibers

Table 26 - Pond Ash with 1.5 % Polypropylene Fibers

CBR Value	**11.16**

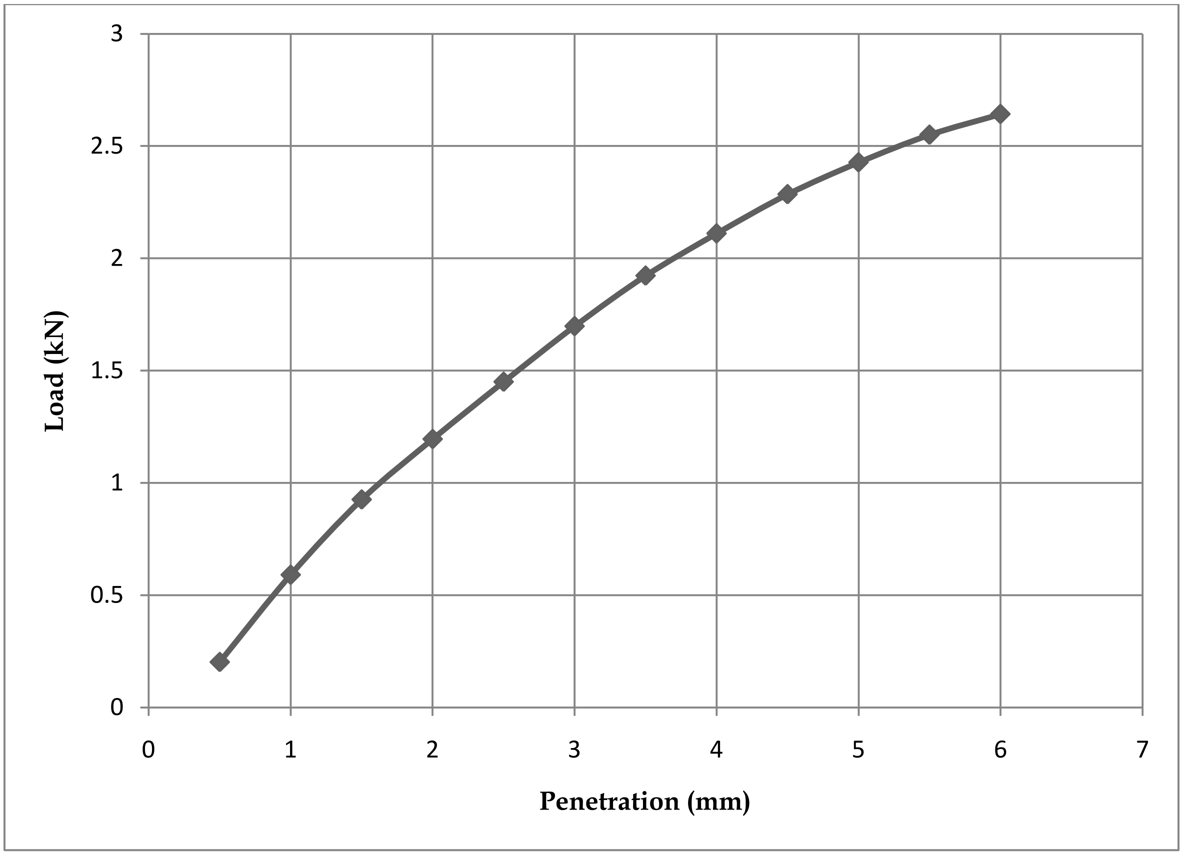


Fig. 24 – Plot between Penetration and Load for Pond Ash with 2.0 % Polypropylene Fibers

Table 27 - Pond Ash with 2.0 % Polypropylene Fibers

CBR Value	**12.05**

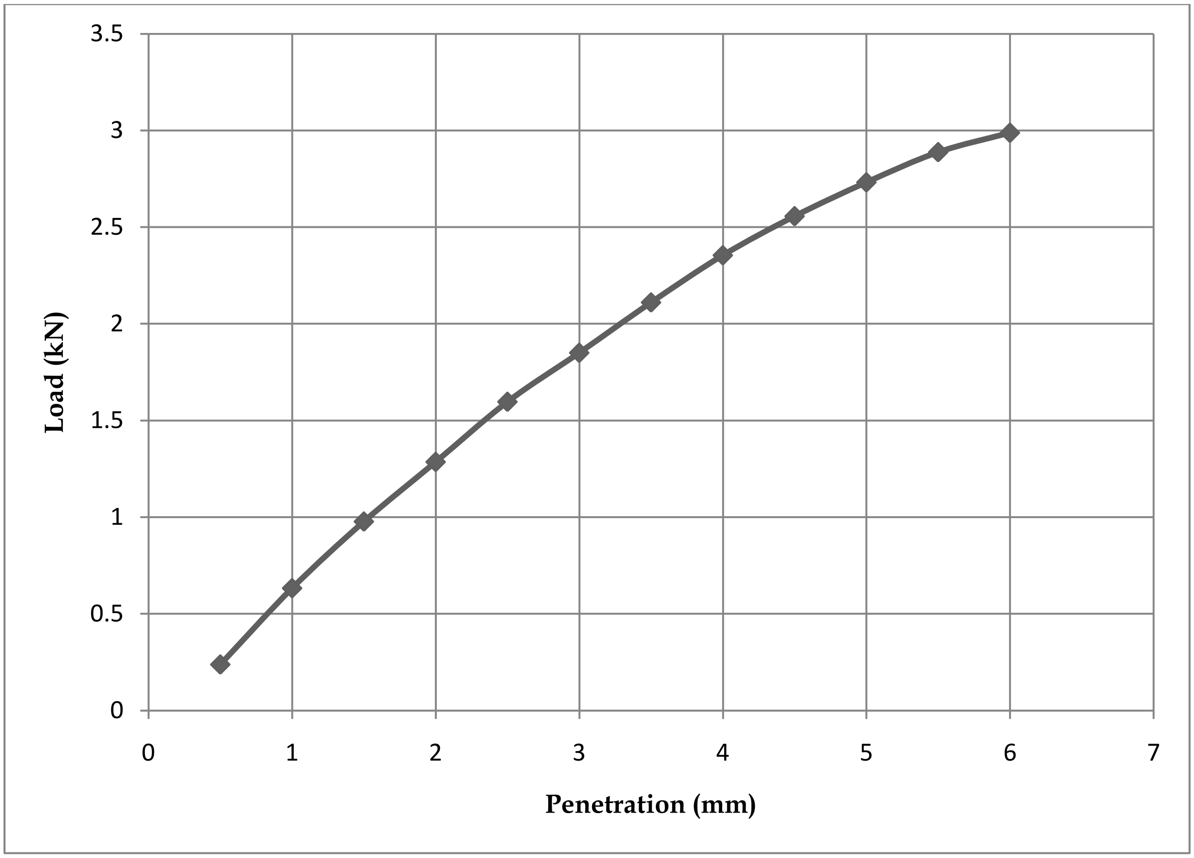


Fig. 25 – Plot between Penetration and Load for Pond Ash with 2.5 % Polypropylene Fibers

Table 28 - Pond Ash with 2.5 % Polypropylene Fibers

CBR Value	**13.55**