RESEARCHERID
THOMSON REUTERS

[Pardeshi, 5(7): July 2018]
DOI: 10.5281/zenodo.1323164

ISSN 2348 – 8034
Impact Factor- 4.022

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

EFFECT OF POLYPROPYLENE ON SHEAR STRENGTH PARAMETERS

Mr.Pravin Shankarsing Pardeshi[*1] & Dr. Sanjay Kulkarni[2]

[*1]PG student, Department of civil- Structural engineering, DYPSOET, PUNE

[2]Head of Department, Department of civil-Structural engineering, DYPSOET, PUNE

ABSTRACT

In this research the shear strength parameter of Highly cohesive soil is discussed. A Comparison of shear strength parameters and ultimate bearing capacity by direct shear test at various water content is calculated. Most of the engineering design methods and parameters of structure on soil have been developed for ideal soil, such as expansive clay which mostly deviates from the reality by atmospheric changes. Black Cotton soil is collected from Nadhenagarnear Kalewadi, Pune which are one of the expands during the rainy seasons and shrinks during the summer seasons. In this paper the shear strength characteristics of Black Cotton soil from Nadhenagarnear Kalewadi, Pune were performing direct shear test 0n different range of Polypropylene as 0.2%, 0.4%, 0.6%, 0.8%. Shear Strength parameters were determined for different water content of 20%, 25%, 30% and 35%.From experimental investigation Black cotton soil for different % percentage of Polypropylene increase the cohesion and small increases in the friction angle

Key words: *Black Cotton soil, Cohesion, internal angle of friction, Polypropylene*.

I. INTRODUCTION

Shear Strength of soil is the most important properties to describe the strength of a soil material and component,against the type of yield and structural failure where material and component fails in shear. The shear strength parameter of black cotton soil is required to addressing numerous practical problem such as slope stability of black cotton soil slopes, design of foundation of heavy structures, and construction of earth embankment on black cotton soil. Black cotton soilis highly plastic clays may derive their shear strength from the adhesion between soil particle or cohesion. In this work the sample of black cotton soil from Nadhenagarnear Kalewadi., Pune region were taken for the research work to study the shear strength characteristics of soil with of soil with different percentage of polypropylene with different water content which is required in the civil engineering works on black cotton soil. Review of the technical literature that limited studies investigated the shear strength behavior of black cotton soil with different percentage of polypropylene & water content. The relation between shear strength parameters and percentage polypropylene is obtained by laboratory test results on direct shear test.

Objective

Main objective of the research work were identified as follows:

1. To Study the geotechnical properties of Black cotton soil and l and also to find out the chances that place in them with increase in PP fibers content.
2. Impact on design of foundation system & suggest measure.(Impact on Bearing Capacity & Structural design).

II. MATERIALS AND METHODS

A. Introduction

Black Cotton Soil are highly expansive soils and is very much prone to large volume changes (swelling and shrinkage) that are directly related to change in water content. This experimental set-up makes it possible for us to quantify cohesion and internal angle of friction in Black Cotton Soil and to study the impact of some of the parameters that affect the intensity and density of soil. These cohesion and internal angle of friction were reduced by increasing the PP FIBERS content in the mix and by increasing the moisture content.

ISSN 2348 – 8034
Impact Factor- 4.022

B. Materials Used

1. Black Cotton Soil I (BC1)

The soil samples or specimens used in test are obtained from different places. BC1which is comparatively dry and having finer size obtained from Farm at Nadhenagarnear Kalewadi, Pune.

Table 1. index properties of bc

Specific Gravity (G)	1.8
Unit mass (γ_{dry}) KN/m^3	1.51
Liquid limit(L_L)	79.28
Plastic Limit(L_P)	51.79
C_u & C_C	4.6 & 0.96

2. PP FIBERS

Here, in this project, soil stabilization has been done with the help of randomly distributed "Polypropylene (PP) fibers*"* obtained from waste materials with 4%lime for make good bonding between fibers and soil.

Table 2. properties of polypropylene

Parameters or property	Values
Fiber types	Single
Unit weight	0.91 gm/cm^3
Average diameter	0.034mm
Average length	12mm
Breacking tensile strength	350MPa
Modulus of elasicity	3500MPa
Fusion point	165^o C
Burning point	590^{o}C

Methodology

For the present work soil sample for experiments is collected from Nadhenagarnear Kalewadi, Pune. The particle sieve analysis is found out by sieve analysis of soil as per IS code 2720 (Part 4) in the laboratory is performed. The index properties of soil is found as per IS Code 2720 (Part 5). Summary of soil characterization data of black cotton soil is presented in Table. On the basis of the results soil is classified as CH as per Indian standard classification of soil. And shear strength parameter are evaluated from direct shear test.

Sample preparation:

The soil used in this study was air - dried, pulverized and sieved over 4.75mm to remove oversized material. Remolded sample were prepared .

For Direct Shear Test

1. To compact Black cotton soil (CH type) at various moisture content for relative compaction.
2. Preparation of samples by different water content & different percentage of polypropylene.
3. Testing is to be conducted on prepared sample with the help of Direct Shear test apparatus for normal stress and constant rate of strain and measure failure opf soil.
4. Measurement of shear stresses and strain with proving ring and dial gauge, plotting the graphs and evaluating shear parameters.

[Pardeshi, 5(7): July 2018]
DOI: 10.5281/zenodo.1323164
ISSN 2348 – 8034
Impact Factor- 4.022

III. EXPERIMENTAL RESULTS

Tables gives the physical soil properties obtained as per IS code provisions in geotechnical laboratory, Civil Engineering Dept Cusrow Wadia Institute of Technology, Pune ,Maharashtra, India.

Table 1. experimental results of 20%water content(BC)sample

Physical Properties	% Polypropylene				
	0 %	0.2%	0.4%	0.6%	0.8%
Cohesion (C)	21.53	22.17	22.58	22.80	23.10
Internal Angle (ǿ)	22.92	23.15	23.60	23.95	24.15
Nǿ	2.28	2.29	2.33	2.37	2.38
Nq	8.61	8.77	9.19	9.57	9.70
Nγ	5.79	5.97	6.44	6.85	7.02
N_C	18	18.17	18.74	19.29	19.40
Bearing Capacity (q_u)	482.8	500.7	519.7	550.7	531.5

Table 2. Experimental results of 25%water content(bc)sample

Physical Properties	% Polypropylene				
	0 %	0.2 %	0.4 %	0.6 %	0.8 %
Cohesion (C)	25.71	26.15	26.71	26.78	26.85
Internal Angle (ǿ)	19.20	19.95	20.10	20.40	20.50
Nǿ	1.98	2.04	2.05	2.07	2.08
Nq	5.91	6.38	6.47	6.66	6.73
Nγ	3.08	3.51	3.60	3.79	3.85
N_C	14.10	14.82	14.94	15.22	15.32
Bearing Capacity (q_u)	417.2	448.8	461.6	473.1	477.7

Table 3. experimental results of 30%water content(BC)sample

Physical Properties	% Polypropylene				
	0 %	0.2 %	0.4 %	0.6 %	0.8 %
Cohesion (C)	26.93	27.15	27.85	28.30	29.05
Internal Angle (ǿ)	18.45	18.95	19.30	19.90	20.10
Nǿ	1.92	1.96	1.99	2.03	2.05.
Nq	5.47	5.76	5.98	6.33	6.47
Nγ	2.68	2.94	3.14	3.47	3.60
N_C	13.40	13.86	14.22	14.72	14.94
Bearing Capacity (q_u)	414.5	428.8	451.6	477.2	496.6

ISSN 2348 – 8034
Impact Factor- 4.022

Table 4. experimental results of 35%water content(BC)sample

Physical Properties	% Polypropylene				
	0 %	0.2%	0.4%	0.6%	0.8%
Cohesion (C)	27.51	27.78	27.98	28.10	28.35
Internal Angle (ǿ)	18.91	19.10	19.50	19.70	20.09
Nǿ	1.96	1.97	2.00	2.02	2.04
Nq	5.75	5.85	6.08	6.22	6.44
Nγ	2.93	3.02	3.24	3.36	3.58
N_C	13.86	14.00	14.34	14.58	14.87
Bearing Capacity (q_u)	433.7	442.7	458.3	468.7	483.4

A. Cohesion (C)

Table 4. cohesion & % polypropylene relation at 25% wc

% Polypropylene	Cohesion
0	25.71
0.2	26.15
0.4	26.71
0.6	26.78
0.8	26.85

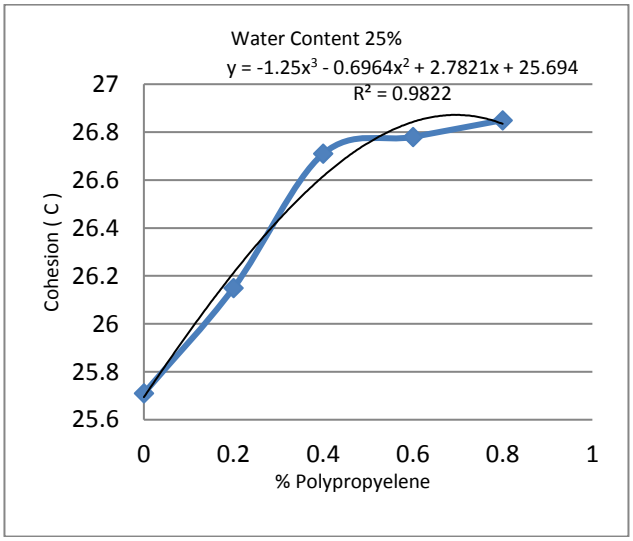

Fig 1. correlation of cohesion and % polypropylene at 25% wc

Table 5.cohesion & % polypropylene relation at 25% wc

% Polypropylene	Cohesion
0	26.93
0.2	27.15
0.4	27.85
0.6	28.30
0.8	29.05

ISSN 2348 – 8034
Impact Factor- 4.022

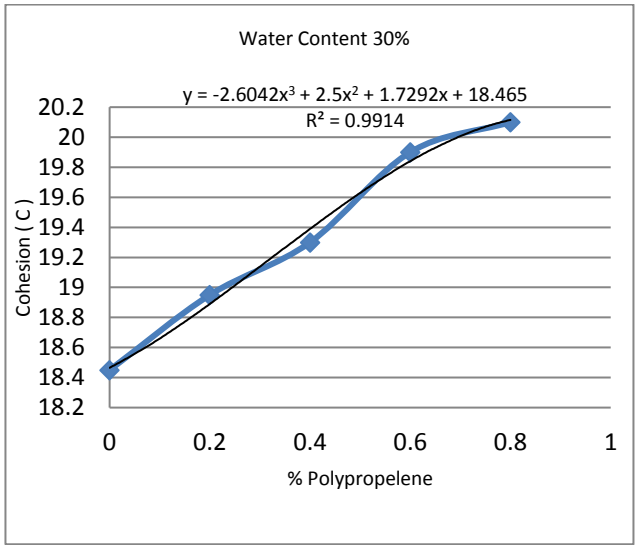

Fig 2. correlation of cohesion and % polypropylene at 30% wc

B .Internal Angle (ǿ)

Table 6.internal angle & % polypropylene relation at 25 % wc

% Polypropylene	Internal Angle
0	19.20
0.2	19.95
0.4	20.10
0.6	20.40
0.8	20.50

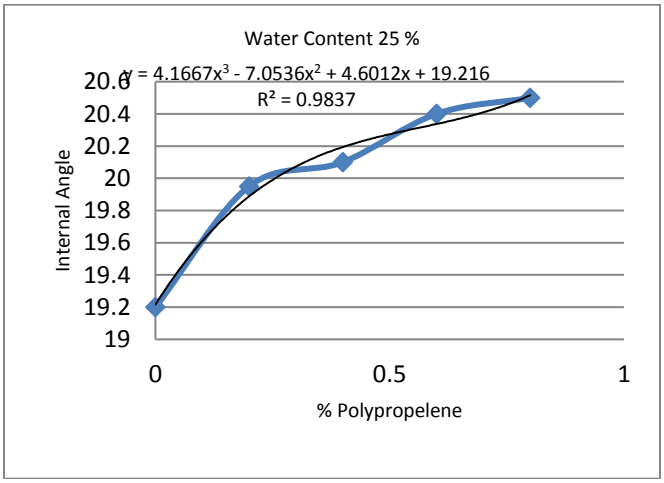

Fig 3. correlation of internal angle and % polypropylene at 25% wc

ISSN 2348 – 8034
Impact Factor- 4.022

Table 7.internal angle & % polypropylene relation at 30 % wc

% Polypropylene	Internal Angle
0	18.45
0.2	18.95
0.4	19.30
0.6	19.90
0.8	20.10

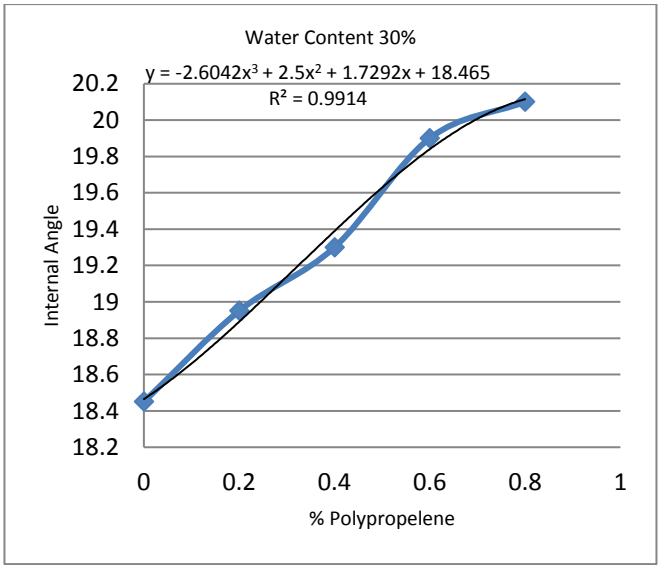

Fig 3. correlation of internal angle and % polypropylene at 30% wc

C .Bearing Capacity (q_u)

Table 8.bearing capacity & % polypropylene relation at 25 % wc

% Polypropylene	Bearing Capacity
0	417.20
0.2	448.80
0.4	461.66
0.6	473.05
0.8	477.78

ISSN 2348 – 8034
Impact Factor- 4.022

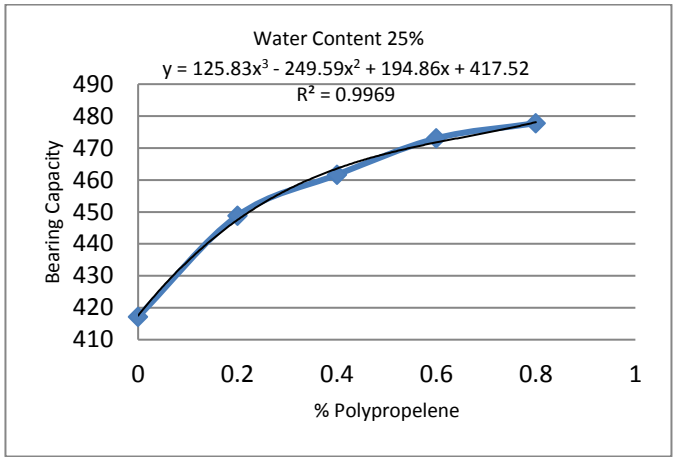

Fig 5. correlation of bearing capacity and % polypropylene at 25% wc

Table 9.bearing capacity & % polypropylene relation at 30 % wc

% Polypropylene	Bearing Capacity
0	414.46
0.2	428.96
0.4	451.65
0.6	477.21
0.8	496.62

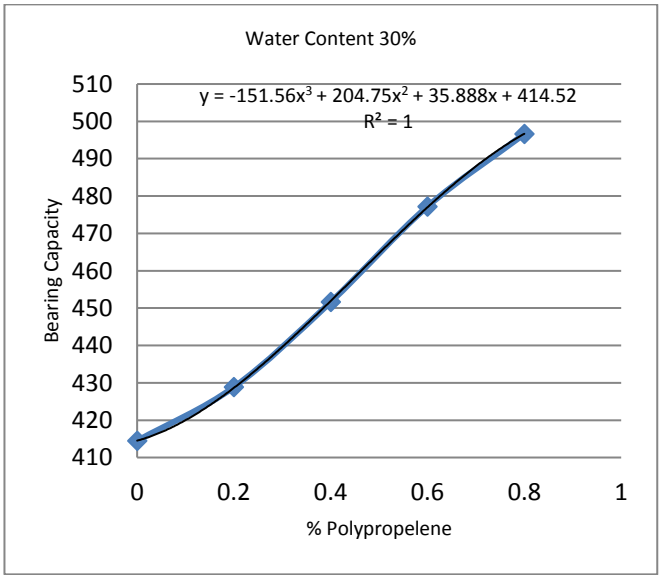

Fig 6. correlation of bearing capacity and % polypropylene at 30% wc

IV. CONCLUSION

The laboratory experiments outcomes are acquired with a view to expand relation between fractal dimension and index residences are tabulated in consequences. Additionally Graphs depicts that correlation among fractal dimension and laboratory experiments of soil samples using appropriate curve becoming method which gives the polynomial equation. Following Desk also suggest that there is that percentage of error among conventional laboratory and image analysis technique varies from 1.45% to 13.37% for soil sample image for determination of

index properties of soil pattern based totally on correlated equation advanced on this studies paintings. The result of present work emphasizes that there is a great potential in the use of fractal dimension for estimating physical soil properties for practical application, with minimum human error.

Based on the experimental investigation following conclusion can be made:

The relation from graphs indicates a strong relation between the Bearing capacity and shear strength parameters. A laboratory testing program was carried out to determine the effect of polypropylene on shear strength parameters. The following conclusions can be made based on the results obtained.

1. From the test results it can be concluded that the shear strength parameters increases with increase in percentage of polypropylene.
2. As water content increases in the soil the shear strength parameter as likely to get reduced.

Further, trend line established for varying percentage of water content and polypropylene with shear strength parameters and bearing capacity with R^2 nearly one, shear strength parameters can be estimated for varying water content which can help in selecting appropriate preventive and curative measures from soil structural behavior.

V. ACKNOWLEDGEMENT

I am deeply indebted to Dr.Sanjay Kulkarni, Head, Department of Civil Engineering, Dr.D.Y.P.S.O.E.T, my advisor and guide, for the motivation, guidance and patience throughout the work & his valuable suggestion during the project.

I extend my sincere thanks to Prof. Vishwajeet Kadlag, M.E. Co-ordinator (Structure), Department of Civil Engineering, for his helpful comments and encouragement for this work. I, also thank all my colleagues who helped me directly or indirectly for completion of this report.

Last, but not least, I would like to thank the authors of various research articles and books that was referred to.

REFERENCES

1. *Das. A.(1954) A revisit to aggregate shape parameters*
2. *Kim ,H. and soleymani , H. (2006) Evaluation of asphalt pavement crack sealing performance using image process technique.*
3. *Bolton The Strength and Dilatancy of Sands.*
4. *Cox,M.R. and Budhu M.2008 A Practical approach to Grain Shape Quantification Engineering Geology.*
5. *Buczko, O. and Milijkovie –Shape analysis of a fm images based on the fractal dimension*
6. *Chinga , G,2006 Shape Descriptors plugin in image J*
7. *J.Fonseca, M.R.Coop-Non-Invasive characterization of particle morphology of natural sands.*
8. *Mellissa R. Cox and Muniram Budhu - Grain Size Quantification and their relationship to dilatancy.*
9. *Seracettin Arasan, Suat Akbulut, A Samet Hasiloglu - Effect of particle size and shape on the grain-size distribution using image analysis*
10. *Suguru Kaneko, Soichi Oka, Naoki Matsumiya -Detection of Cracks in Concrete Structures from Digital Camera Images,*