Study of Properties of Soil near Atigre Villege, Maharashtra

A D Katdare[1], T B Patil [2], R R Bakare[3], R B Patil[4], S D Shinde[5], A S Sarwadi[6]

[1]*Assistant Professor, Dept of Civil Engg, Sanjay Ghodawat Institutes, Atigre, India*
[2,3,4,5,6]*UG student, department of civil engineering, Sanjay Ghodawat Institutes, India*

Abstract *In this work, some geotechnical properties of soil in Atigre area , Maharashtra have been found out. Samples are collected from studying area. These soil samples were subjected to routine laboratory tests. The main tests include, determination of Atterberg limits, density, specific gravity of soil soilds, permeability etc. Plasticity index (>17) clay, hence soil is classified as high plastic and cohesive. Toughness index 0.33, flow index 80.89.These properties can be used by designer as a preliminary guideline for design.*

Keywords: *Atterburg, c, densiyt, soil propertires*

I. INTRODUCTION

Soil Mechanics is the branch of civil engineering that concern the application of the principles of mechanics, hydraulics and to certain extent, chemistry, to engineering problems related to soils and structures. Site feasibility study for geotechnical projects is most beneficial before starting any project. Site survey usually takes place before the design process begins in order to understand the characteristics subsoil upon which the decision on location of the project can be made. For problems in soil mechanics should provide the basic knowledge about soil. Also, the properties of soil should be determined correctly in order to construct a structure which is safe.

II. STUDY OF AREA

This paper presents properties of soil at a site in Atigre Region, Maharashtra. Properties of soil from Atigre (tal.- Hatkanangle ,dist.-Kolhapur, Maharashtra, India) have been studied. In this project tests like standard laboratory and field test , from conducted laboratory and field test have been conducted. The test results have been presented in this paper.

III. METHODOLOGY

Study of the soil properties from the rural area is necessary for determination of test for the safety purpose of structure.

Determination of Test

A. Laboratory Test

1) Water Content
   a) Oven Drying Method
   b) Pycnometer Test
2) Specific Gravity
3) consistency limit
   a) Liquid Limit Test
   b) Plastic Limit Test
   c) Shrinkage Limit Test

B. Field Test

4) Sieve Analysis Test
5) Permeability test
   a) Constant Head
   b) Falling Head Method
6) Shear Test
   a) Triaxial Shear Test-UU (IS-2720-PART-11)
   b) Direct Shear Test
   c) Unconfined Compressive Strength Test of Soil

IV. RESULTS AND DISCUSSION

After collecting the samples, first water content of the sample has been determined.

A. ***Determination of water content by oven drying***

N	Description	Determination No.		
		I	II	III
1	Mass of container + Mass of wet soil (M1) g	125	127	130
2	Mass of container + dry soil (M2) g	111	113	115
3	Mass of empty container g (M3)	29	29	29
4	Mass of solids (M4) g	82	84	86
5	Mass of water (M5) g	14	14	15
6	Water content (%) = (M5/M4)*100	17.1	16.6	17.4

The average water content is found to be 17.02 %. .

B. ***Pycnometer test***

Specific gravity of soil solids has been determined [2]. The results are shown in Table 1.

Table 1 Determination of specific gravity of soil soilds

Sr. No.	Description	Test No.		
		I	II	III
1	Mass of Pycnometer (M_1)	660	680	690
2	Mass of pycnometer + soil (M_2)	800	820	830
3	Mass of pycnometer + soil + water (M_3)	1780	1790	1780
4	Mass of pycnometer + water (M_4)	1700	1710	1710
5	Specific gravity of soil solids	2.33	2.33	2.16
Average Value of G = 2.27				

C. ***Determination of Consistency Limits***

Atterber's limits have been found out**.**

a. Liquid limit test

Liquid Limit is performed by using Casagrande's liquid limit apparatus. The results are shown in Table 2.

Table 2 Determination of liquid limit

Sr No.	Determination	I	II	III
1	Container No.	A	B	C
2	Weight of container	22.57	26.75	29.04
3	Weight of container + wet soil	57	59	48
4	Weight of container + dry soil	46.34	49.43	42.55
5	Weight of water	10.66	9.57	5.45
6	Weight of oven dry soil	23.77	22.68	13.51
7	Water content (%)	71.83	53.37	49.32
8	No. of blows	13	22	29

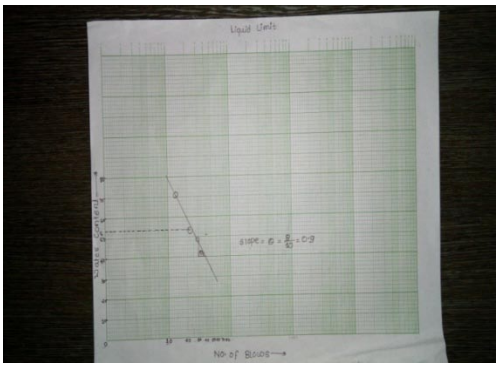

Fig. 1 Graph of liquid limit

b) Plastic Limit Test

Plastic limit test results are tabulated in Table 3.

Table 3 Determination of plastic limit

Description	Container	
	I	II
Mass of container + lid = M_1	25.86	28.86
Wt. of container + lid + wet sample = (M_2)	33.05	33.96
Wt. of container + lid + dry sample = (M_3)	31.30	31.99
Wt. of dry sample = ($M_3 - M_1$)	5.44	6.13
Mass of water in soil = (M_3-M_2)	1.75	1.91
Water content (%) = {(M_3-M_2)/(M_3-M_1)}100	32.17	32.14

c) Shrinkage Limit Test

Following observations have been taken in Shrinkage limit test:

a) Water content of wet soil

1. Mass of shrinkage dish = 72.9 gm
2. Mass of shrinkage dish + wet soil=114.0 gm
3. Mass of shrinkage dish + dry soil=101.1 gm
4. Mass of dry soil = 28.2 gm
5. Mass of water = 12.9gm
6. Water content of wet soil = 45.15%

b) Volume of wet soil

1. Mass of Shrinkage dish = 82.9
2. Mass of mercury filling + shrinkage dish = 405.5gm
3. Volume of wet soil = 405.5-12.9 = 332.6 cc

c) Volume of dry soil:

1. Mass of evaporating dish = 117.89gm
2. Mass of mercury displaced by dry soil = 229.69 gm

From above calculations, shrinkage limit of field soil is calculated to be 18.16%

D. *Sieve Analysis Test*

Results of sive analysis are presented in Table 4.

Table 4 Sieve analysis test

Sieve No.	Sieve Size	Mass Retained (gm)	Percentage Retained (%)	Cumulative Percentage Retained	Cumulative Percentage Passing
1	4.75 mm	140	13.4	13.4	86.6
2	2.36 mm	100	9.57	22.97	77.23
3	1.00 mm	260	24.90	47.87	52.13
4	600 µ	120	11.49	59.36	40.64
5	300 µ	220	21.07	80.43	19.57
6	150 µ	180	17.24	97.67	0.33
7	90 µ	17	1.63	99.3	0.7
8	Pan	7	0.67	99.97	0.03
Total= 1044 gm					

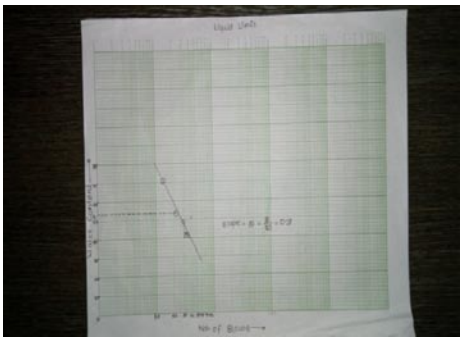

Fig. 2 Graph for grain size analysis

From Figure 2, values of Cu and Cc are found out to be 8.4 and 10.5 respectively.

E. Falling head test

Falling head test is a common laboratory test used to find coefficient of permeability of the soil in laboratory [3][4]. Following observations have been obtained in the falling head test.

Observation:

1. Area of stand pipe (a)= 4.91 cm²
2. Cross section area of specimen (A)= 78.54cm²
3. Length of soil specimen (L) = 12.7 cm
4. Initial reading of stand pipe (h1) = 87 cm
5. Final reading of stand pipe (h2) = 72.33 cm
6. Time (t) = 20 sec
7. Test temperature (T) = 37 degree

From above observations, coefficient of permeability at 27°C (K) is found to be 7.332 x 10^{-3} m/ sec.

F. Direct Shear Test

Direct shear test is used to calculate the shear strength parameters of the soil (c and ϕ). The test is performed and

Table 5 Direct Shear Test

Sr. no.	**Acting load (kg)**	**Division**	**Shear test (kg /cm^2)**
1	0.2	6	0.04
2	0.4	11	0.07
3.	0.3	9	0.06

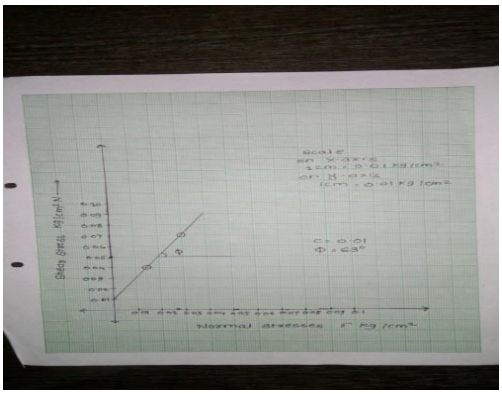

Fig. 4. Graph for direct shear test

G. Core Cutter Method

In field methods, core cutter method is used to find the in-situ density of the soil [1].

Table 6 Core Cutter observations

Sr. no	**Description**	**Determination no.**	
		I	II
1	Internal diameter of core cutter in (cm)	3.8	3.8
2	Internal height of core cutter in (cm)	15	20
3	Volume of cutter in cm^3	170.11	226.82
4	Wt. of core cutter(W_1) in gm	520	360
5	Wt of core cutter (W_1)+soil(W_2) (gm)	836.50	708.29
6	Wt of soil (W_2-W_1) (gm)	316.5	348.29
8	Dry density of soil (kN/m^3)	15.12	14.13

V. CONCLUSION AND DISCUSSION

1) Water content by oven drying method = 17 %

2) Specific gravity of soil solids = 2.27

3) Determination of consistency limits:
   a) Liquid limit = 58.17%
   b) Plastic limit = 32%
   c) Shrinkage Limit = 18.16%
4) Sieve analysis test
   Cu and Cc Value are found t8.4 and 10.5. This shows class C. The soil is well graded soil.
5) Falling head method = 7.332 x 10^{-3} m/ sec

Above results will be useful to the designer as a preliminary guideline for designing any structure in this region.

REFERENCES

[1] IS 2720: Part XXIX : 1975 Methods of Test for Soils - Part XXIX : Determination of Dry Density of Soils In-place by the Core-cutter Method
[2] IS 2720: Part 3 : Sec 1 : 1980 Methods of test for soils: Part 3 Determination of specific gravity Section 1 fine grained soils
[3] IS 2720: Part 17 : 1986 Methods of Test for Soils - Part 17 : Laboratory Determination of Permeability
[4] Arora, K. R.. Soil Mechanics and Foundation Engineering, Standard Publisher Dist., New Delhi, 2009
[5] Punmia, B. C., Jain, A. K. and Kain, A. K. Soil Mechanics and Foundations, Laxmi Publications, New Delhi, 2005