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Landslide study of Jabhaliwadi , Panhala region and causes of landslide by determining Index properties of soil.

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Abstract:

Landslide is the phenomena of sliding of upper loose soil surface over another soil surface.landslide study includes geological and Geo-technical properties of soil before and after landslide. Slope failures are common geo hazards in the near Panhala fort region during monsoon period.. In the present study an attempt is made to understand the mechanism of debris flow at Jambhaliwadi Panhala region. And to discuss the actual causes of failure in the area .**The area is still failure prone,** and may fail as number potential failure surfaces exist in the site. The Geo-technical analysis of the slopes were carried out to identify the type of failure happened on the slope and also to examine whether the chances of the profile to failure still exists in the site. Angle of internal friction (Ø), plastic limit, liquid limit and plasticity index of the samples were determined in the Geo-technical laboratory.

Key Words: Jabhaliwadi ,Panhala region, Debris Flow,Index properties,Plastic limit,Liquid limit.

1.Introduction-

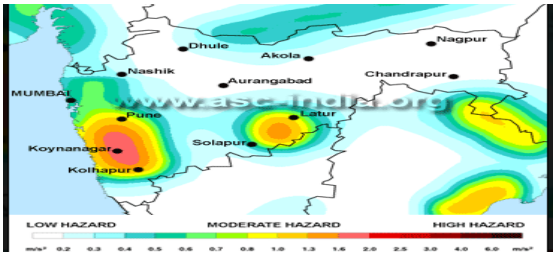
Slope failures are common disasters in this area **due to heavy rainfall** and modification of hill slope for cultivation. A landslide is actually a mud flow that occurred at Jabhaliwadi ,Panhala region, during monsoon period of 2019. June and July had caused a damage to property in small amount because is very small village with population of 20 peoples but land of Jambhaliwadi is used mostly for farming and animal shades by peoples live near Jambhaliwadi. Causalities were avoided as the were a few meters away from the rolled down debris.

2.Study Area -Area of our interest is located at **Navli (Jambhaliwadi),Taluka-Panhala and Dsitrict- Kolhapur**.Actual landslide takes place from near **feet of Panhala fort**.

Location

3.Geology of area-

Soil present at the location is **lateratic soil** having moderate to **high permeability**. And **columnar joints** are present beneath soil layer which have structure similar to vertical columns and these joints have very high permeability.Area of our research is located in **seismic zone 3.**



Seismic Zone

4.Field Investigation and Methodology-Slope Angle of hill where landslide takes place is about **70 degree**.Highest Rainfall Intensity recorded is about **250-350 mm/day**. Most of the land Used for cultivation and animal shades.And there is **no any provision for drainage of rain water**. (No Gutters, Drainage Pipes).

Site Images

4.1 Methodology for determination of Index properties.

4.1.1 Collect the test sample from site (By Augar boring and Core Cutter).

Collection of specimen according to Geo-tech laboratory field books.

Core Cutter Sampling

4.1.2 Test procedure-

We Conduct various test to find out index properties of sample.(Water content, Specific gravity,,Aterbergs limits).

4.1.3 Water content (W) -

Soil water content is the mass of water in the soil, measured as the difference between the moist **soil** and the soi**l** dried at 105°C, known as the oven-dry weight. Note that soil water content is expressed per unit mass of oven-dried soil.

Average water content of tested samples S1-40.15%, S2-37.51% and S3-41.07.

4.1.4 Specific gravity (G)-

The term "Specific Gravity" (SG) is used to define the weight or density of a liquid as compared to the density of an equal volume of water at a specified temperature. The temperature used for measurement is usually 39.2°F (4°C), because this temperature allows water to assume its maximum density.

Specific gravity of the tested sample is 2.23.

4.1.5 Particle size distribution-

Particle size distribution, also known as gradation, refers to the proportions by dry mass of a soil distributed over specified particle-size ranges. Gradation is used to classify soils for engineering and agricultural purposes, since particle size influences how fast or slow water or other fluid moves through a soil.

From the tested samples of soil percentage of fine grained soil is more than the coarse grained soil.

4.1.5 Aterbergs limit-

4.1.5.1 Plastic limit-

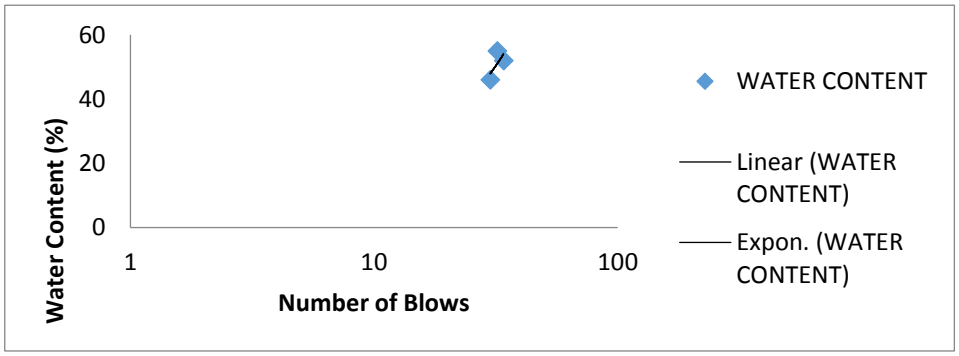
Plastic limit is the water content in clay soil below Which it stop to behave like a plastic material. it starts to crumble when rolled in threads of 3 mm diameter. At this water content, the soil losses its plasticity.Liquid limit of clay soil is the water content at which soil change from plastic to liquid states.

Plastic limit of sample S1-20%, S2-24.5% and S3-21.5%.

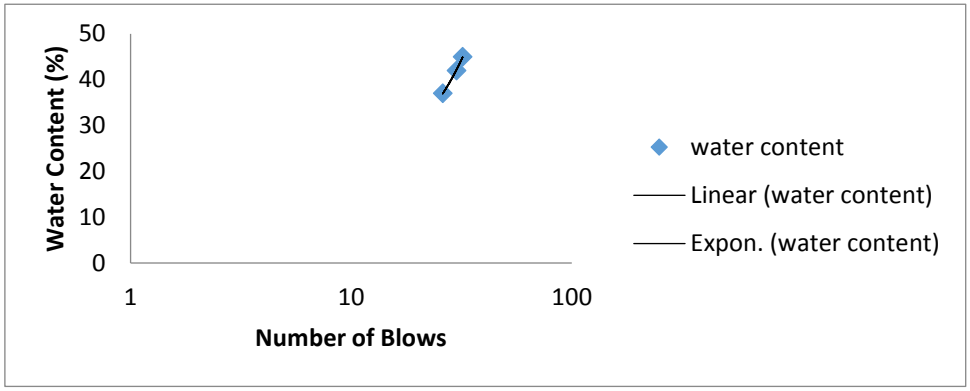
4.1.5.2 Liquid limit-

The liquid limit is the moisture content at which the groove, formed by a standard tool into the sample of **soil** taken in the standard cup, closes for 10 mm on being given 25 blows in a standard manner. This is the limiting moisture content at which the cohesive **soil** passes from liquid state to plastic state.

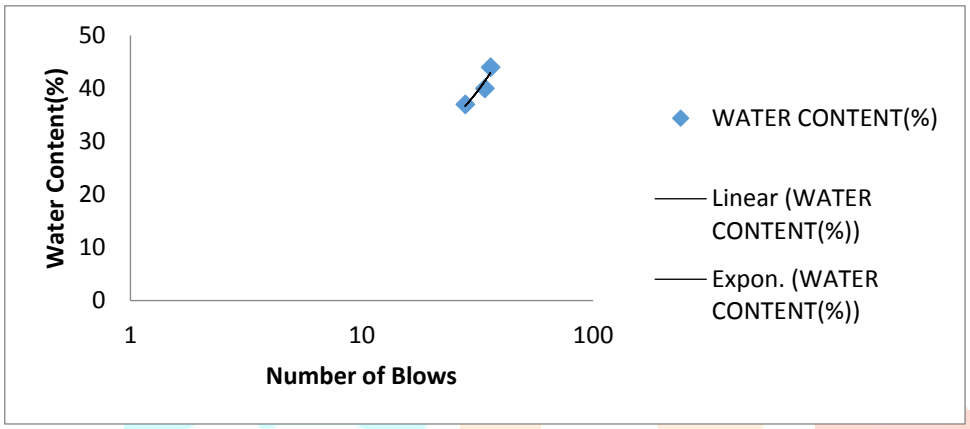
Liquid limit of tested samples is S1-40%, S2-35.5%, S3-34%.



Liquid Limit =40.5%

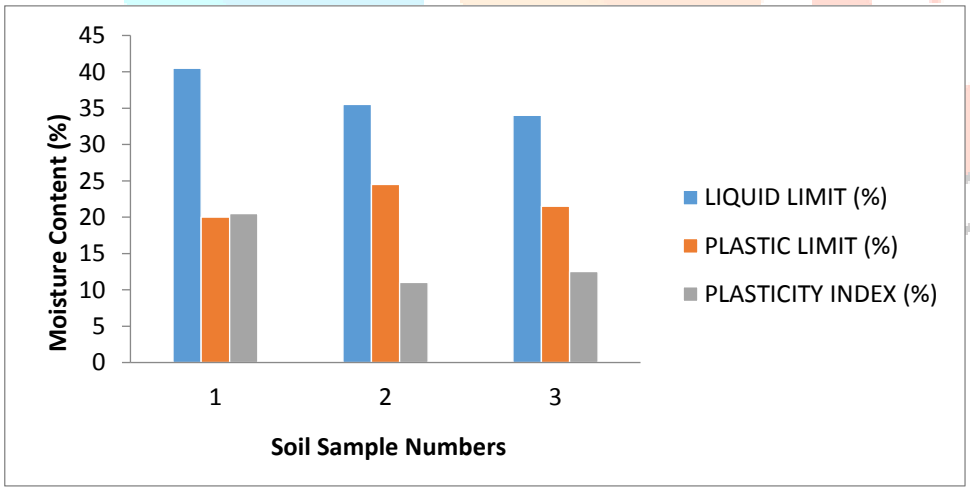


Liquid limit=35.5%



Liquid limit =34%

Graph No 1-Graphs for liquid Limit



Graph No.2 -Combined Graph of Aterbergs limit

4.1.6 Field density-

The in situ density of natural soil is needed for the determination of bearing capacity of soils, for the purpose of stability analysis of slopes, for the determination of pressures on underlying strata for the calculation of settlement and the design of underground structures.

4.1.6.1 Dry Density-

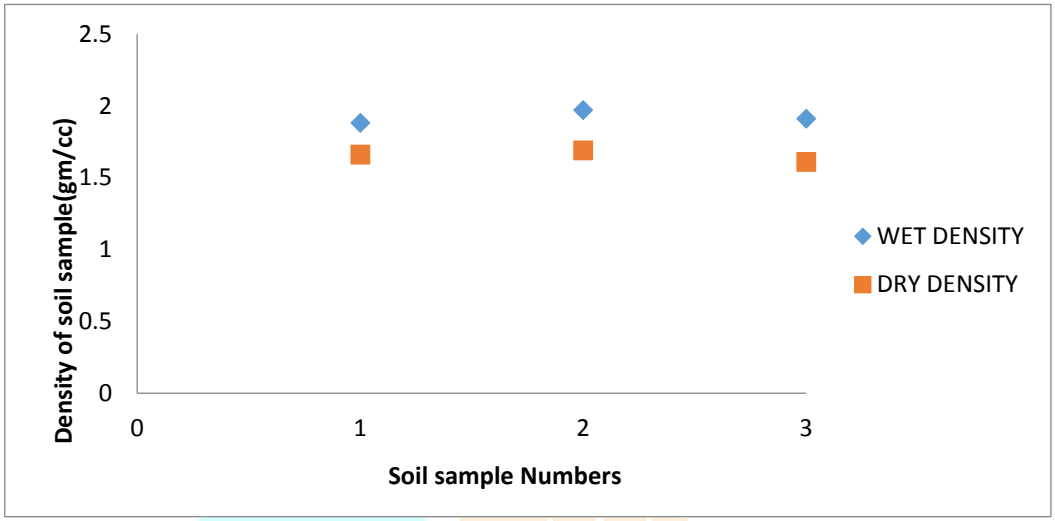
It refers to the density of the soil, when it is taken in the dry state. The soil mass is commonly a mixture of air, water and soil solids. The dry density refers to the soil solids. It is otherwise called as dry unit weight of soil.

Dry densities of soil samples are S1-1.66, S2-1.69, S3-1.61 in gm/cc.

4.1.6.2 Wet Density-

A quantity of soil or soil and aggregate mixture is prepared at a determinable moisture content and compacted in a standard mold using a manual or mechanical rammer. The wet mass of this compacted sample is divided by the volume of the mold to determine the wet density.

Wet densities of samples is S1-1.88, S2-1.97 and S3-1.91 in gm/cc.



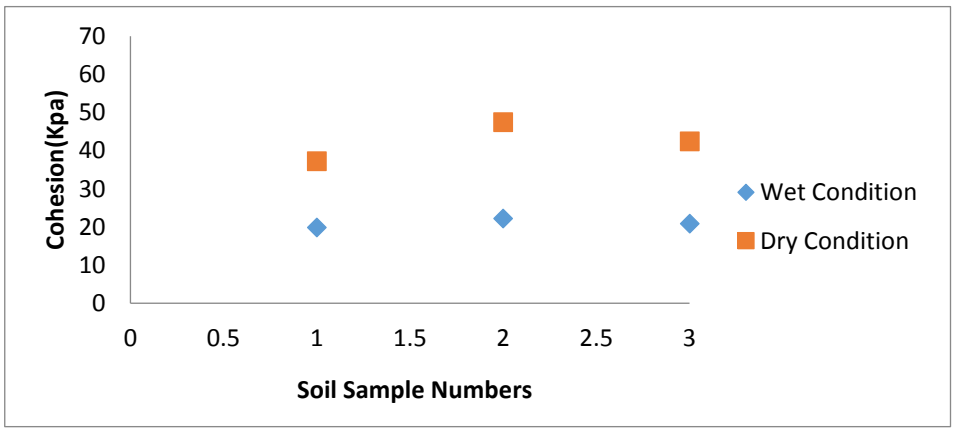
Graph No 3-Graph for field densities.

4.1.7 DIRECT SHEAR TEST

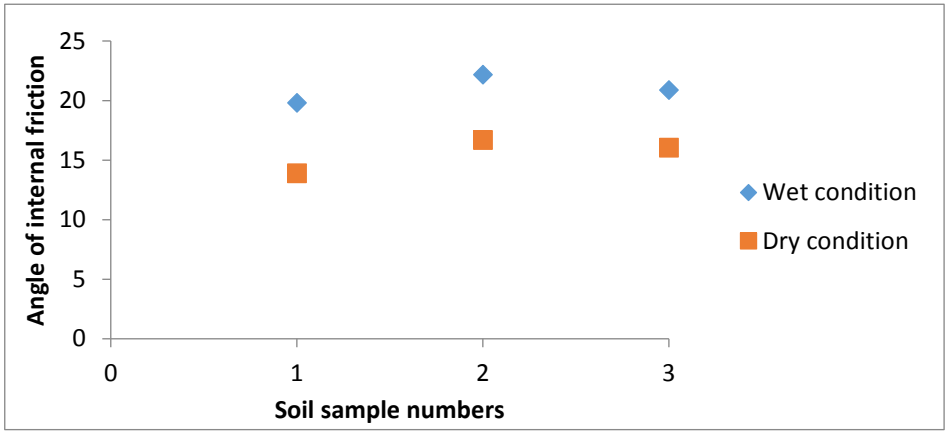
To find **cohesion** and **Angle of internal friction** of soil in **Dry condition and wet condition.**
A direct shear test is a laboratory or field test used by Geo-technical engineers to measure the shear strength properties of soil or rock material, or of discontinuities in soil or rock masses.The test is, however, standard practice to establish the shear strength properties of discontinuities in rock.

Sample Number	Dry Condition		Wet Condition	
	Cohesion	Angle of Internal Friction Kg/cm2 (From graph)	Cohesion	Angle of Internal friction Kg/cm2 (From graph)
S1	0.380	12.68	0.202	13.90
S2	0.484	15.37	0.226	16.69
S3	0.433	14.03	0.213	16.03

Table No-1



Graph No.4-Cohesion of soil samples in dry and wet condition

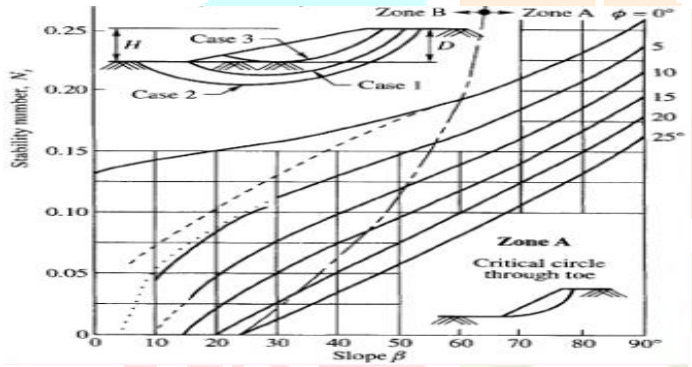


Graph No.5-Angle of internal friction in dry and wet condition

4.1.8 Slope Stability Number-

It is the method used to evaluate slope stability for homogeneous soils having cohesion. This method is proposed by the Taylor. It is based on the principle resistance of soil mass against sliding, because of cohesion and internal friction acting over the failure plane.

Next step we use is to find out stability number from angle of internal friction and slope angle from table no 13 and 14 and Graph for Taylor's Stability Number for Circles passing through the toe and below or above toe for the slope angle of 70 degrees.



Graph No.6- Slope Stability Number.

For Dry sample-

Sample No	1	2	3
Slope Angle	70	70	70
Angle of Internal Friction	12.68	15.37	14.03
Stability No by using graph and interpolation	0.15	0.17	0.16

Table 2

For Wet sample-

Sample No	1	2	3
Slope Angle	70	70	70
Angle of Internal Friction	13.90	16.69	16.03
Stability No by using graph and interpolation	0.16	0.18	0.18

Table 3

4.1.9 Calculation of Safety Factor-

The important ego-technical properties affecting stability of a slope are shear strength of material, particle size distribution, density, permeability, moisture content, plasticity and angle of repose. The strength of rock mass is a very important factor that affects the **s**tability of slopes.And we using Taylors method for calculation of factor of safety **(FOS=C/S*W*H**). C is cohesion,S is slope stability factor,W is unit wt of soil and H is height of slope failure..Height of Slope failure is taken is 15 m.Cohesion is taken from graph No.4 and slope stability number taken from table no 2 and 3.

Average factor of safety for dry soil samples is 1.5 and Average factor of safety is 0.5.

5.Results and Conclusions-

The paper is mainly going to study the physical and index behaviour of soil in monsoon and causes of landslide in area of interest.The following important conclusions have been drawn by Field observations, analysis of the soils by different engineering test.

1. Water content of soil is suddenly increases due to heavy rainfall in less time, average water content is about 39% (from table 1,2,3) and soil is lateratic type, having high to moderate permeability due to this water percolate into soil and soil became **highly saturated and unstable and flows down-word.**

2. From the basic survey,**Due to absence of gutters and drainage media** percolated water does not have way to drain out and water remains as it is in soil.

3. After studying index properties we conclude that average factor of safety for research is in wet condition is very low I.e 0.5 to **over-saturation** than the dry condition I.e 1.5.

4. By comparing the factor of safety for both situation we conclude that in **monsoon season this slope is very unstable and dangerous.**

6.References-

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approach.

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