International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

Landslide Zonation Mapping and Risk Management Studies in Tamhini Ghat Section

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Abstract –*Landslide is the movement of mass of rock, debris, or earth down a slope. Landslides are type of "mass wasting," which denotes any down-slope movement of soil and rock under the direct influence of gravity. The study area is very important from the point of view of previous landslides and heavy excavation. For the mapping and analysis purpose, the field visit and sampling will be conducted over a stretch of about 10 km starting from either site of Tamhini ghat section. Rock and soil samples are being collected at regular intervals and analyses using various instruments and processes. Landslides will continue to be a geologic hazard in Tamhini ghat section, Maharashtra. However, knowledge of landslide location, lithology and morphology will reduce their impacts.*

Key words – **Landslide, Tamhini ghat.**

1. INTRODUCTION –

1.1 Explanation –

Tamhini ghat is a mountain passage located between Mulshi and Tamhini in Maharashtra, India. Situated on the crest of western ghat mountain ranges, Tamhini ghat is noted for its surroundings comprising scenic waterfalls, lakes and dense woods. Most of the landslide studies have been attempted in order to find out the spatial susceptible and landslide events are very frequently observed and recorded, particularly in those areas the assessment of temporal hazard rate can be more beneficial and can produce more significant hazard scenarios and further studies can help in carrying out the quantitative and qualitative assessment of vulnerable element at risk as well. The process of landslides proneness mapping comprises of preparation of different maps based on the factors influencing the occurrence of landslide with the help of aerial photographs, satellite imagery, topographic maps and geographical maps.

1.2 Problem Statement –

Landslide cause property damage, injury and death and adversely affect variety of resources. Landslide can cause seismic disturbances; landslide can also result from seismic disturbances, and earthquake-induced slides have caused loss of life in many countries. Landslide can cause disastrous flooding, particularly when landslide dams across streams are breached, and flooding may trigger slides. The landslide tragedies have killed many people and also destroy the facilities such as roads, houses, bridges and others. This phenomenon also causes a major socio-economic impact on people and their whole live. All these tragedies where triggered by heavy rain. Therefore, real time rainfall values are valuable indicator of the risk level of landslides at the hilly terrain. In the past, there are various types of instruments and methods that have been used to monitor landslide phenomena such as geological methods, geodetic methods, and geotechnical methods. All the investigations are carried out before and after any landslide tragedy.

2. METHODOLOGY –

Various methods and technics have been employed to analyze the cans tine factor of landslide and produce maps portraying the probability of similar phenomenon in future.

A brief of line of different methods is described below.

- **Direct Method:**

The direct method is consist of geomorphological mapping where

i. Evaluation can be done by establishing the direct relationship between the hazards and environmental setting during survey at the site.
ii. Distribution analysis for actual location by field survey and aerial photographic interpretation.

- **Indirect Method:**

The indirect methods include two different approaches namely heuristic and statistical techniques:

i. Heuristic approach is based on the factor influencing landslides. Such as rock type, slope analysis, landform and land use pattern etc.
ii. Statistical approach: In statistical analysis the combination of factor influencing landslide occurrence on the past, determine statistically and qualitative predictions are made for landslides free areas with similar conditions.

3. TESTS –

3.1 Sieve analysis

For determination of grain size distribution by dry sieve method for given sample of soil. Plot distribution curve and IS classification of given soil sample.

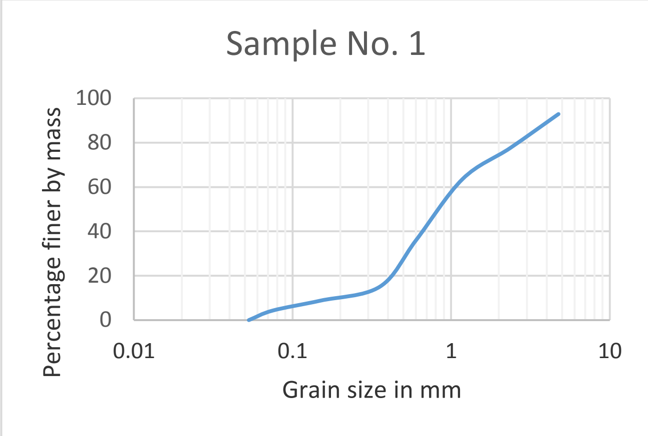
Following picture shows the Sieve analysis done on dry sample-

Sample 1:

Table – Observation table for Sample 1

Sieve	Grain size in mm	% finer by mass
No.4	4.75	92.896
No.8	2.36	77.614
No.18	1.18	63.594
No.30	0.6	35.979
No.50	0.355	15.057
No.100	0.15	8.779
No.200	0.075	4.308
	Pan	0

Following graph shows Grain size Vs % finer by mass-

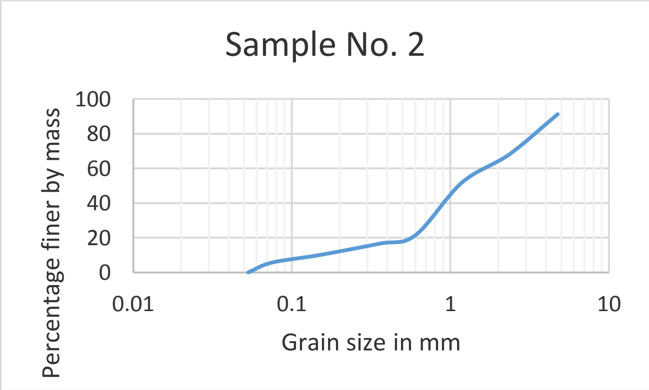


Sample 2:

Table-Observation table for Sample 2

Sieve	Grain size in mm	% finer by mass
No.	4.75	91.237
No.	2.36	68.153
No.	1.18	51.749
No.	0.6	21.351
No.	0.355	16.564
No.	0.15	10.046
No.	0.075	5.704
	pan	0

Following graph shows Grain size Vs % finer by mass-



3.2 Core cutter method-

For determination of field density/ in situ density by using core cutter method as per the IS 2720 (Part -29): 1975 (Reaffirmed 1988).

Following picture shows the core cutter method done on field –

Table- Observation table for core cutter

Sr. No.	Observation	Sample
1	Mass of core cutter in gm	949
2	Mass of core cutter +Wet soil (gm)	2194.37
3	Mass of wet soil in gm	1245
4	Diameter of core cutter cm	10
5	Height of core cutter cm	12.5
6	Volume of core cutter in cc	981.44
7	Container no.	1
8	Mass of container in gm	14.67
9	Mass of container +wet soil in gm	39.02
10	Mass of container+ dry soil in gm	35.4
11	Mass of dry soil in gm	20.73
12	Mass of water in gm	3.62
13	Water content (w) %	17.46

3.3 Determination of liquid limit:

Liquid limit is the water content corresponding to the arbitrary limit between liquid and plastic state of consistency of soil. It is defined as the minimum water content at which the soil is still in the liquid state, but has a small shearing strength against flowing which can be measured by standard available means. For determine the liquid limit as per the IS 2720(Part - 5).

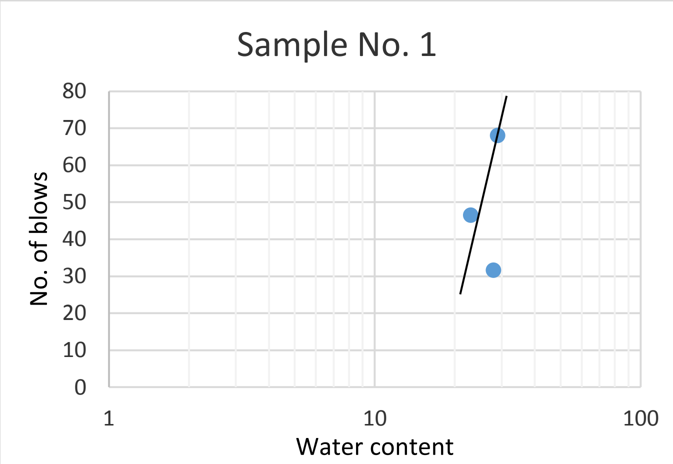
Following picture shows the liquid limit test done on the sample in lab-

Sample no.1

Table- Observation table for liquid limit

Container no.	1	2	3
No. of blows	28	29	23
Mass of container (M1)	28	28	28
Mass of container + wet soil (M2)	78	70	69
Mass of container +dry soil (M3)	66	53	56
Mass of dry soil (M3-M1)	38	25	28
Mass of water (M2-M3)	12	17	13
Water content %	31.57	68	46.4
Average water content%	48.66		

Following graph shows Water content Vs No. of blows-

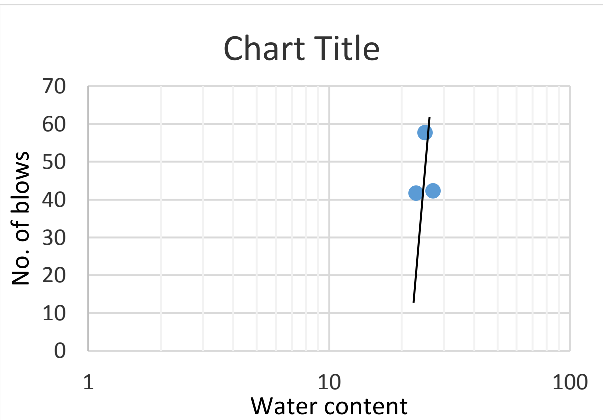


Sample no.2

Table- Observation table for liquid limit

Container no.	1	2	3
No. of blows	23	27	25
Mass of container (M1)	28	28	28
Mass of container + wet soil (M2)	62	65	69
Mass of container +dry soil (M3)	52	54	54
Mass of dry soil (M3-M1)	24	26	26
Mass of water (M2-M3)	10	11	15
Water content %	41.66	42.3	57.7
Average water content%	47.55		

Following graph shows Water content Vs No. of blows-



3.4 Determination of plastic limit:

Plastic limit is the water content corresponding to an arbitrary limit between the plastic and semi-solid states of consistency of a soil. It is defined as the minimum water content at which soil will just begin to crumble when rolled into a thread approximately 3 mm diameter. Determination of plastic limit as per IS (Part 5)-1965.

Following picture shows the plastic limit test done on sample in lab-

Table- Observation table for Plastic limit Sample no. 1

Container no.	1	2	3
Mass of container M1	28	28	28
Mass of container + wet soil M2	48	49.5	46
Mass of container + dry soil M3	43.5	46.5	41
Mass of dry soil(M3-M1)	14	18.5	11
Mass of water(M2-M3)	4.5	3	5
Water content%	32.14	16.21	45.45
Average water content	31.26		

Table- Observation table for Plastic limit Sample no. 2

Container no.	1	2	3
Mass of container M1	28	28	28
Mass of container + wet soil M2	56.5	62	54

Mass of container + dry soil M3	51	56	51
Mass of dry soil(M3-M1)	20	16	18
Mass of water(M2-M3)	5.5	6	3
Water content%	27.5	37.5	16.66
Average water content	27.22		

4. Zonation mapping-

For the mapping and analysis purpose, the field visit and sampling will be conducted over a stretch of about 8km starting from the either side of the Tamhini ghat section. Rock and soil samples are being collected at the regular intervals from the following zones and analyzed by using total station, GPS, EDM etc.

Table- Following table for landslide zone intervals

Sr.no.	Co-ordinate	Height in m	Area sq. m
1	18^{0}27′12″N 73^{0}26′5″E	10.2	113.78
2	18^{0}28′23″N 73^{0}26′34″E	11.3	246.13
3	18^{0}28′24″N 73^{0}26′34″E	8.4	72.89
4	18^{0}27′50″N 73^{0}24′47″E	13	150.33
5	18^{0}27′49″N 73^{0}24′46″E	8.5	175.64
6	18^{0}27′68″N 73^{0}24′44″E	7.5	63.86
7	18^{0}27′48″N 73^{0}24′34″E	3.8	26.23
8	18^{0}27′48″N 73^{0}24′34″E	9	200.34

5. RESULT-

1. From the semi log graph of Sieve analysis the sample soil is uniformly graded (poorly graded) soil.
2. From Core cutter test-
   i. Bulk density of soil = 1.268 gm/cc
   ii. Dry density of soil = 1.028 gm/cc
   iii. Voids ratio = 1.287
   iv. Degree of saturation = 33.50%
3. Liquid limit of given soil sample = 57.7%
4. Plastic limit of given soil sample = 3126%
5. Plasticity index of given soil sample = 26.44%

6. CONCLUSION –

1. From the result it is conclude that the soil is poorly graded and which is more susceptible for landslides.
2. The above results used to analyze a characteristic of liquid limit and plasticity index of soil susceptible for landslides in given zones.

7. ACKOWLEDGEMENT –

We extend our deep sense of gratitude and indebtedness to our guide Mr. Kailash Biradar (DYPCOE, Akurdi) for his kind attitude, invaluable guidance, valuable suggestion, kind interest and encouragement which helped us caring out our project work.

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10. IS: 2720(Part 5)-1965 for Plastic limit

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