

## Study of Landslide Hazard and Mitigation Methods

Atesh Jadhav<sup>#1</sup>, Pankaj Bhagat<sup>#1</sup>, Rahul Patil<sup>#1</sup>, Anil Bhoir<sup>#1</sup>, Prof. Samridhhi Shelavale<sup>#2</sup>  
Department of Civil, VOGCE, Mumbai University,  
Aghai, Dist. Thane, Maharashtra, India.  
*anil.bhoir94@gmail.com*

**Abstract:** This paper has been written on study of landslide occurrence at hillside areas in India. Sometimes the landslide occurs due to many natural and manmade reasons, but only these reasons are not causes of landslide occurrence at that place which are very low suspected to landslide or not lie in landslide zones and another. Landslide occur in Malin village in Pune district where rainfall was 10 cm which is common in that area but still landslide is occur at Malin, so with the natural and manmade factors there is need to investigate the soil and to find out the changes in soil which leads landslide.

**Keywords** –Specific gravity, Materialism, Liquid limit

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### I. INTRODUCTION

Landslides, the downward and outward gravitational displacement of slope forming materials, may damage any human structure and may even cause the loss of lives when they occur in a catastrophic way. Landslide is a general term for a wide variety of down slope movements of earth materials that result in the perceptible downward and outward movement of soil, rock, and vegetation under the influence of gravity. The materials may move by falling, toppling, sliding, spreading, or flowing. Some landslides are rapid, occurring in seconds, whereas others may take hours, weeks, or even longer.

Landslides usually occurs at steep slope, improper cutting of slopes for the construction of roads and other structures, so there is need to prevent landslide by use of proper prevention method according to location and condition of that areas. By use of proper prevention methods. Landslides can be prevented, which will result in no human damage, environmental damage objectives for this project are to prevent the landslide by causing hazardous effect on human life and natural sources applying preventive method To find out natural and man-made factors this causes landslide. To study one of the Malingaon landslide and apply the test on soil sample. To strengthen regional, national and community level capacity for mitigation, management and coordinate response to natural and technological hazard and the effect of climate change.

### II. METHODOLOGY



#### A. Natural factors

The landslides were caused by rainfall that had started previous day, the village receiving 10 cm (4 in) rainfall and continue throughout following day. Rise in water table by rain and also the effect of construction of Dimbhe dam near Malin village.

#### B. Manmade factors

Deforestation of the area which was done heavily. Changing the agricultural practice by farmers and also cutting of slope on hill for

#### C. On field test

##### 1.) Dry strength test

In this test involve to crumble the dry soil by fingers, soil analyses at side was done it shows that no need of more pressure required to crumble the soil, the soil was very loose and easy to crumble.

### 2.) Thumb penetration test

Thumb penetration test involves an attempt to press the thumb firmly. If the thumb makes an indentation in the soil with great difficulty then soil is cohesive. If the thumb penetrates easily then soil may probably have less cohesion, from experimental studies done on samples shows that soil was probably less cohesive.

### D. Soil analysis results

Test	Results
Specific gravity	2.53
Liquid limit	51%
Plastic limit	23%
Plasticity index	28%
Sieve analysis	Fines more than 50%
Maximum dry density	1.31 g/cc

Consequences of test demonstrate that sp.gr of soil was diminishing extensively. Plasticity of the dirt was high, soil was in the classification of mud. Furthermore, the fluid farthest point of soil was expansion, which demonstrates that the dirt was high plastic soil with residue and increment in plastic cutoff and fluid breaking point. Soil was pervious, which diminishes water holding limit of soil, workability was poor and main factor was that shear quality of the dirt was extremely poor. Dry thickness of soil was additionally diminished and soil turned out to be free. Because of poor shear quality and union less soil, all the material alongside soil was come to down, this was likewise a fundamental reason of avalanche of Malin town.

### E. Impact of malin landslide on village-

Malin landslide causes 151 deaths which is worth loss of human being. A huge loss of property and assets were observed after the disaster along with loss of infrastructure, lifeline facilities, farmland, transport breakdown.

### F. Suggestion-

Planting of trees on slopes may help to reduce the effects and intensity of landslide, which holds the soil in its position. Provide steps on slopes.

## III. PREVENTION METHODS

### A. Restraining Structures

Limiting structures are for the most part used to control slant strength issues (tallness <4 m). The legitimately outlined and developed inflexible controlling structures are reasonable where space is confined. Holding dividers are raised to convey more noteworthy security to unsafe slants or to bolster existing avalanches.

### B. Concrete retaining walls

The concrete gravity walls are very expensive and are advantageous for important structures and locations. Such walls require a foundation in bedrock or good soil below the slip surface and shall be safe from scour, frost and surface water. Proper drainage measures shall be provided to prevent water accumulating behind the wall.

### C. Excavation Methods

Excavation methods contribute to increased stability of the soil mass beneath a slope. The main methods used for landslide control are removal of unstable materials, flattening of slopes, benching of slopes, change of line or grade and alteration of slope geometry.

### D. Removal of unstable materials

Controlling structures are by and large used to control incline soundness issues (height <4 m). The legitimately planned and built inflexible limiting structures are appropriate where space is confined. Holding dividers are raised to convey more prominent steadiness to risky slants or to bolster existing avalanches.

### Restraining piles

Controlling heaps are utilized where, because of the restriction of space, it is unrealistic to smooth the inclines or utilize other gravity sort structures to enhance the slant dependability. Heaps are introduced in the sliding soil mass and bed rock through boreholes in the sliding mass to balance out an avalanche through resistance and are utilized to avoid little scale avalanches. These heaps might comprise of steel or fortified solid heaps. The heap is characterized as

a bowing heap since its length is for quite some time contrasted with its breadth.

[10] Soil Mechanics and Foundation Engg. K. R.AroraStandard Publishers.

#### *Flattening of slopes*

This method consists primarily of proper slope design followed by proper surface drainage measures. These are best suited to slides moving down slope towards a road and not for slides that undermine a road on its downward slope. A uniform slope is adapted from ditch line to the top of the slope. The surface of failure and method of analysis depend upon whether the slope is infinite or a finite one. Most talus soil are likely to be stable on 2 : 1 slopes for a cut up to 6 m in height but may require 3 : 1 slopes for cuts greater than 9 m in height.

#### IV. CONCLUSION

Avalanche was happen at Malin town was because of the normal components as precipitation synthetic variables as a deforestation, impact of Dimbhe dam. From the dirt test we likewise infer that the dirt was ended up attachment less, shear quality was additionally lessen and soil was turned out to be free. Because of leakage of water and the water holding limit is less here.

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