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REPORT ON LANDSLIDE IN MALIN VILLAGE IN PUNE

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ABSTRACT

This paper has been written to study on rapid landslide occurrence at the hillside development areas, in the village of Malin in Pune, western India. From the landslides investigations reports, it is shown that this area was affected by very strong monsoon rainfall in the two days prior to the landslide. The discussion will be on landslides: the causal factors, the impacts, mitigation actions.

KEYWORDS: Hillside, Landslides, Development, Slopes, Building on Slopes,

INTRODUCTION

A landslide occurs when part of a natural slope is unable to support its own weight. For example, soil material on a slippery surface underneath, can become heavy with rainwater and slide down due to its increased weight. A landslide is a downward or outward movement of soil, rock or vegetation, under the influence of gravity. This movement can occur in many ways. It can be a fall, topple, slide, spread or flow. The speed of the movement may range from very slow to rapid. The mass of moving material can destroy property along its path of movement and cause death to people and livestock. Although landslides usually occur at steep slopes, they may also occur in areas with low relief or slope gradient. Listed below are some examples. Cutting failures can occur during highway excavations, building construction, etc. River bank failures Lateral spreading of soil material Collapse of mines, waste piles and garbage fills Slope failures associated with quarries and open-pit mines Underwater landslides on the floors of lakes of reservoirs and offshore marine settings[11].

LANDSLIDE IN MALIN

On 30 July 2014, a landslide occurred in the village of Malin in the Ambegaon taluka of the Pune district in Maharashtra, India. The landslide, which hit early in the morning while residents were asleep, was believed to have been caused by a burst of heavy rainfall, and killed at least 134 people.The landslide was first noticed by a bus driver who drove by the area and saw that the village had been overrun with mud and earth. In addition to those dead, more than 160 people, and possibly up to 200, were believed to have been buried in the landslide in 44 separate houses. Rains continued after the landslide making rescue efforts difficult[13].

NATURAL CAUSES OF LAND SLIDE

1. The landslides were caused by heavy rainfall that had begun the previous day, with the village receiving 10.8 cm (4 in) of rain on 29 July and the downpour continuing throughout the following day.
2. The environmental destruction that resulted in the landslide is believed to have more than one cause.
3. Lowering of water table in the last few years and sudden rise observed due to the heavy rainfall[12].

ARTIFICIAL CAUSES OF LANDSLIDES

1. Deforestation in the area was cited as a cause contributing to the landslide was
2. Changing agricultural practices that the villagers had recently shifted from cultivation of rice and finger millet to wheat, which required levelling of steep areas, which contributed to instability of the hills.
3. The construction of the nearby Dimbhe Dam ten years ago was considered as a possible reason.
4. The instability of the hillsides was due to the construction activities, which are often done without careful analysis of environmental consequences [3].

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IMPACT OF LANDSLIDES IN MALIN VILLAGE

Though initial reports stated that the landslide had killed 17 people, officials expected the death toll to exceed 150.[10] As of 4 August 2014, the death toll had reached 134. The bodies so far recovered were of 50 men, 64 women and 20 children.[4]

Figure 1 Rescue team working hard to remove the people buried under the clay.

EFFECTS OF LANDSLIDE ON MALIN VILLAGE

A huge loss of property and assets were observed after the disaster along with loss of infrastructure, lifeline facilities farmland[14]. Loss in productivity of agricultural or forest lands due to being buried by debris. Reduced property values due to unwillingness of people to purchase disaster prone land. Loss of revenue due to loss of productivity, transport breakdown, etc. Increased cost due to investments in preventing or mitigating future landslide damage. Loss of human productivity due to death and injury[17]. Reduction in quality of life due to the deaths of family members and the destruction of personal belongings, which had a great sentimental value.

Disaster had a profound impact on people's emotional wellbeing affecting their feelings, thoughts, actions, and relationships[10].

PREVENTION AND REMEDIATION OF LANDSLIDES

Many methods are used to remedy landslide problems. The best solution, of course, is to avoid landslide-prone areas altogether. Before purchasing land or an existing structure or building a new structure, the buyer should consult an engineering geologist or a geotechnical engineer to evaluate the potential for landslides and other geology-related problems.

Listed below are some common remedial methods used when landslide-prone slopes cannot be avoided.

IMPROVING SURFACE AND SUBSURFACE DRAINAGE

Because water is a main factor in landslides, improving surface and subsurface drainage at the site can increase the stability of a landslide-prone slope. Surface water should be diverted away from the landslide-prone region by channeling water in a lined drainage ditch or sewer pipe to the base of the slope. The water should be diverted in such a way as to avoid triggering a landslide adjacent to the site. Surface water should not be allowed to pond on the landslide-prone slope[7].

EXCAVATING THE HEAD

Removing the soil and rock at the head of the landslide decreases the driving pressure and can slow or stop a landslide. Additional soil and rock above the landslide will need to be removed to prevent a new landslide from forming upslope. Flattening the slope angle at the top of the hill can help stabilize landslide-prone slopes.

BUTTRESSING THE TOE

If the toe of the landslide is at the base of the slope, fill can be placed over the toe and along the base of the slope. The fill increases the resisting forces along the failure surface in the toe area. This, in turn, blocks the material in the head from moving toward the toe. However, if the toe is higher on the slope, adding fill would overload the soil and rock below the toe, thus causing a landslide to form downslope of the fill.

CONSTRUCTING PILES AND RETAINING WALLS

Piles are metal beams that are either driven into the soil or placed in drill holes. Properly placed piles should extend into a competent rock layer below the landslide. Wooden beams and telephone poles are not recommended for use as piles because they lack strength and can rot[4].

Because landslides can ooze through the gaps between the piles, retaining walls are often constructed. Retaining walls can be constructed by adding lagging (metal, concrete, or wooden beams) horizontally between the piles. Such walls can be further strengthened by adding tiebacks and buttressing beams. Tiebacks are long rods that attach to the piles and to a competent rock layer below the ground

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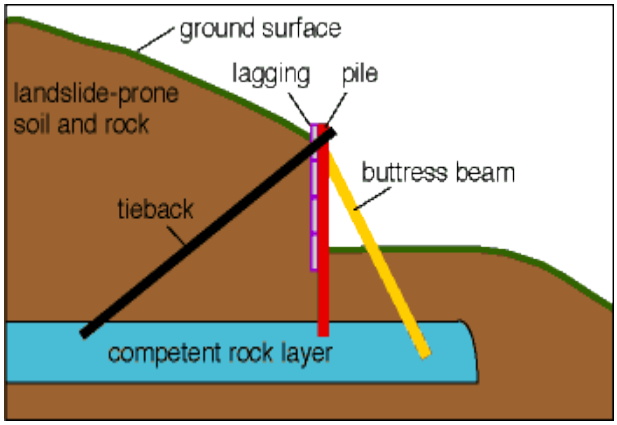
surface. Buttressing beams are placed at an angle downslope of the piles to prevent the piles from toppling or tilting. Retaining walls also are constructed of concrete, cinder blocks, rock, railroad ties, or logs, but these may not be strong enough to resist landslide movement and could topple.

Diagram of a retaining wall with tiebacks and buttress beams. Tiebacks are metal rods that extend from the piles to a competent rock layer below the ground surface. Buttress beams are metal beams that are inclined downslope from the piles that prevent the piles from toppling. Lagging consists of wooden, metal, or concrete beams placed upslope and between the piles to fill in the gaps[3].



REMOVAL AND REPLACEMENT

Landslide-prone soil and rock can be removed and replaced with stronger materials, such as silty or sandy soils. Because weathering of shales can form landslide-prone soils, the removal and replacement procedure must include measures to prevent continued weathering of the remaining rock. Landslide material should never be pushed back up the slope. This will simply lead to continued motion of the landslide[5].

PRESERVING VEGETATION

Trees, grasses, and vegetation can minimize the amount of water infiltrating into the soil, slow the erosion caused by surface-water flow, and remove water from the soil. Although vegetation alone cannot prevent or stop a landslide, removal of vegetation from a landslide-prone slope may initiate a landslide[5].'

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