Landslide of 17th July 2004 at Km 67, Roing-Hunli Road, Lower Dibang Valley, District, Arunachal Pradesh

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Abstract

The eastern part of Arunachal Pradesh comprising of Lower and Upper Dibang Valley, Lohit and Anjaw districts in particular have been facing immense rock/landslides and formation of undeterred sinking zones. Sympathetic faults and shears developed parallel to Mishmi thrust have contributed to the damage. The paper deals with one of the multiple slides that occurred along the Roing-Hunli road in Lower Dibang valley, analysed the causes and put forward some suggestions and remedial measures.

Introduction

Arunachal Pradesh with its varied lithology enacted upon by Main Frontal Thrust, Main Boundary Fault, Main Central Thrust and innumerable number of other localized faults, folds shears and sutures becomes more susceptible to complex structural disturbances at the two major plate junction. Falling in seismic zone V, the entire state is vulnerable to frequent earthquakes that have rendered the state prone to frequent rock/ landslides and formation of undeterred sinking zones, throughout the State. The eastern part of Arunachal Pradesh comprising of Lower & Upper Dibang Valley, Lohit and Anjaw districts in particular have been facing immense slide/sinking zone problems.

Roing-Hunli-Anini road is the only artery that connects the interior parts of Lower Dibang Valley district in Arunachal Pradesh and is of strategic importance being the defence link to the borders of China very near to Anini. Thus landslides or road breach in these crucial links deserves/require special attention.

Excavated during the early seventies, this part of the Roing –Hunli- road in Lower Dibang Valley district in Arunachal Pradesh was seemingly safe. As per local information, quarrying for road aggregates was on for quite a number of years. The area forms the mountainous part of northeastern Arunachal Pradesh between Mayudia and Hunli (Fig-1). The area forms the mountainous part of the northeastern Arunachal Pradesh, between Mayudia and Hunli (Lower Dibang Valley district). Although rain in these parts may occur in any part of the year, monsoonal rain starts from May and continue up to end of August and the highest precipitation recorded

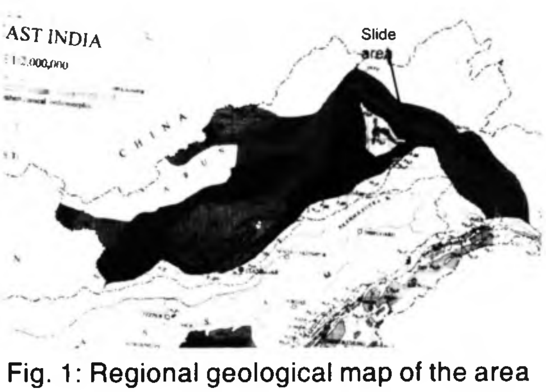

Fig. 1: Regional geological map of the area

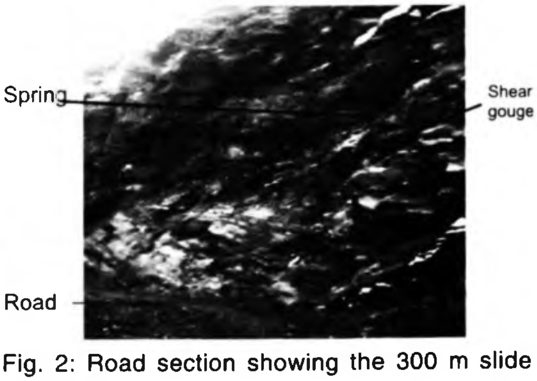

Fig. 2: Road section showing the 300 m slide affected portion

in a span of 21 days in July 2004 was 1456 mm. The slope failure took place after 21 days of continuous downpour in July 2004.

Description

This is a very critical slide that got activated on 17th July 2004 between **67.540 km to 67.840 km** by unprecedented rainfall for 21 days (Fig. 2). The length of the slide from crown to road is about 70 m and from road level to toe is about 90 m. The slope profile is 50° to 55°. It is basically a composite slide, comprising three different rock types as banded quartzite, phyllite and mica schist affected by five intersecting joint sets with a blanket cover of soil. A number of shears ranging in thickness from 2 cm to 2 m criss-cross the rock, rendering it blocky and at places friable. The Foliation Shear is 1m thick, while the other shear trends N70°W-S70°E, has sub-vertical dip and have up to 1 cm thick clay gouge. Due to folding, the foliation trend changes from 35° S20°E to 30° towards S50°W in dark grey phyllite that also contain a 50 cm parallel shear.

The joint sets as recorded are-

J_1: Foliation joint, dip 20° to 35° towards S20°E (hill side), thinly foliated, close spaced (1 to30 cm)

J_2: Dip 55° towards E, valley forming, spacing 30 to 50 cm.

J_3: Strike N20°E-S20°W, dip sub-vertical to 85°SE

J_4: Dip 55° towards N, undulated surface

J_5: Dip 65° towards N20°E.

Fig. 5: Close space joints and fractures has rendered the rock blocky and friable

Causes

Geologically the rock units in the area are highly fragile with several sets of well-developed and criss-crossing open joints, some of which are unfavourably oriented. In addition the slopes are steep and have thick overburden, mostly of highly porous soil. The relatively long period of rainy season compounds the problem. Factors such as steeply cut slopes for road making, heavy load of traffic, improper maintenance of roadside drains, absence of proper slope protection measures etc., have to a great extent contributed to the instability of the roads. The Roing-Hunli road has a history of landslides (N.Majumdar 1979-80, Ashraf et al 1982-83, Nageswaran et al 1989-90).

The road is aligned N70° to 75°W –S70° to 75°E in the slide area. J_5 is nearly parallel to the road and steeply dips towards down hill direction, J_4 is slightly oblique to it and also dips towards the valley, while J_2 and J_3 are close spaced, perpendicular to the adverse joints (J_4 & J_5) and contribute to the blocky spalling. From crown to toe there are abundant transverse and longitudinal cracks along which rain-water penetrates. The occurrence of a 'nala' near the crown that branches out adds to the seepage and aggravates the damage. The rock is an assemblage of meta-basic schist, fine grained granite gneiss, quartzites, mica-phyllites and amphibolites (Burhanuddin & Nandy, 2003-04), all of which dip into the hill.

Landslide area

Due to prominent sub-vertical joints, (one parallel to the road and the other perpendicular to the road) dipping valley ward and shears – large rock blocks (4 m x 2 m) rest precariously on slope above the road with discerning cracks (Fig. 5). As gathered from meteorological data from 1992 to 2005 from Hunli and Anini in the vicinity, it has been concluded that incessant drizzle with intermittent heavy down pours from February to April and June to October was the major causative factor. Heavy snowfall in winter months opens up the cracks and joints due to frost, followed by thawing in warmer days loosens up the rocks, leading to failure.

Suggestion

1. Lessening of head-load (loose rock & muck) at crown.
2. Creation of berms/benches on the slope

above road, each supported by breast wall.

3. Rock-bolting at selected places with wire-mesh shot-creting.

4. Construction of concrete roads and lined drains. Suitable drainage arrangements are essential to protect the slopes and roads.

5. Construction of a massive retaining wall in one or in parts at the toe, deeply founded in fresh rock.

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