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Studies pertaining to environmental degradation caused by Fagla Landslide, Ramban area, Jammu and Kashmir State

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Abstract

Fagla landslide at a distance of 160 km from Jammu, very near to Ramban area, national highway –IA, is one of the notorious landslides in J & K. Among many other causes, such as deforestation, high relief brittle nature of rocks, the main cause of landslide revealed from field investigation is great water ingress present in the rocks in the form of springs, nallas and water falls. The problem gets compounded during excessive rains – when phyllite salty rocks develop shear joints resulting in breaking apart big rock blocks from the main mass turning in to huge scree material and finally getting accumulated on the road. For mitigation of the slide, proper disposal of run off by digging wells and connecting the same to the horizontals tunnels readily(Tunake model) as applied in kamenose landslide in Japan successfully, is suggested for Fagla landslide, the only strengthened by anchoring at vulnerable ponts, An adequate forest cover in the water shed areas of the landslide site from Rambvan to Anokhi fall together with growing vetiver grass in the whole belt in the northeast are other methods suggested to control the slide successfully.

Keywords: *Mitigation, Fagla landslide, Ramban area, Jammu and Kashmir State*

Introduction

Geological and environmental factors have immense influence on land use. Because of this, the necessity of geotectonic map depicting all aspects of environment is strongly felt for large- scale development planning and programming all over the country. The areas of high energetic relief in various parts of Jammu and Kashmir Himalaya, the land slide aspects of environment atand directly in the way of any development activity. Many engineering structures get greatly affected, if there is no stability of landmasses. Engineers, road builders and repair departments worldwide are busy in studying the rock stability failures and the causes of land slide throughout the world.

The National Highway –IA in J & K is affected by number of slides occurring at number of places (Didwal, 1980, Kachroo asnd Hussain, 1980, Singh, 1991), The active landslide areas exist between Ramban to Banihal. Every year the land slides occur enroute Jammu Srinagar Highway causing accidents, besides the road remaining closed for days together, making Kashmir valley cut off from the other states of India. The effect is great during rains. Heavy rainfall and its associated landslides occur in lesser Himalayan belt of Himalaya. In lesser Himalaya, the major belt constitutes the autochthonous folded belt, the rocks get mostly squeezed and deformed dut to development of new share joints from time to time, as these lie between Murree thrust in the south and Panjal thrust in the north (Janpangi *et al,* 1986). The sheer joints get all the more dilated due to heavy rainfall and finally break apart, resulting in landslides af large magnitude (Greenwood, 1957; Hissain and Katti, 1980; Prasd and Verma, 1980; and Zaruba and Manel, 1969). Due to

great water ingress many a times, large rock masses get detached along deep joints and due to gravity, roll down in the form of land slides along with mud and scree material (Yidbhir, 1980). Although in the form of landslides has been taken up by investigators earlier but still much remains to be done. Fagla landslide, very near to Ramban area, is one of the notorious landslides and the present authors on this paper present detailed report of investigation in respect of this slide and suggest the necessary methods of control for the same.

Fagla landslide lies at 160 km distance from Jammu (Fig.1) near Bichlari nalla and Chenab Rivar confluence point. After crossing Ramban on the highway (151 km from Jammu) at a distance of 4 km on the road , one enters the Fagla lamdslide area near Seri. The fagla village is situated at a height of 1584 m above mean sea level. The debris of the slide includes scree material and mudflows, which are removed from time to time by the BEACONS and other agencies (Fig.2). The Fagla landslide is reached after traversing 5 km from Seri village. It is situated on the sharp bend on the national highway alongside Bichlari nalla flowing from Banihal. Bichlari nalla is the northwest and Chenab River in the southwest have carved deep gorges and from the road these gorgers are visible (Fig.3 and 4). The whole area from Seri to Anokhi fall (Fig.5) is a sinking area. The rocks are represented by slate/phyllite sequence. Towards north, these beds are thin and have an altitude of N20^{o}W,30^{o}E. The sinking area lies in between two nallas along which there is a local fault (Fig.6). In the east near the fault, the strata dips at 77^{o} – 80^{o} E and the rocks are represented by Olive –green phyllites. The whole area is a shooting stone area.

Towards north and northeast of Fagla, there are two forests Digdoul forest in the north and Balhot forest in the east, and through these numerous nallas flow towards the road side. Besides these, many springs and waterfalls occur in this zone. There is abundance of ground water drainage that percolates through phyllites/slates, which are abundantly present as the dominant rock type at Fagla road section (Fig.1). This results in the fracturing of the rocks in the form of big blocks and as such poses a danger for the vehicles that pass through this area. The whole area of Fagla stands at a height; therefore, wind erosion is also maximum in this area. During rainy season, not a single day misses when the scree material will not come to the toe portion of the slide. At times when there is maximum rain, the Bichlari nalla becomes torrential and that time through this narrow road, which is full of debris, the vehicles can hardly pass on such occasions the road remains closed for traffic for days together.

Geological Succession

The Fagla area and its environs have been mapped by a number of workers earlier, namely Bhatia and Bhatia (1973), Sharma *et al.*(1973,1979), Shah, (1980), Didwal (1980), Janpangi *et al,*(1986), Razdan and Dhir (1989). The revised geological succession of the area and the area to the northeast (including Kishtwar) has been studied in detail and geological succession discussed in detail by Raina *et al.* (1990).

The geological succession given by earlier workers and after the field investigation by the present authors, the stratigraphy of the road section is given as follows:

	SALKHALA GROUP	
	——————Panjal Thrust——————	
Sincha Formation	Phyllites, Slates, Quartzites	Late
	Dolomite, Marls and Pebby bands	Precambrian
	——————Unconformity——————	
Ramban Slates	Phyllites, Slates, Quartzites,	Early
	Sand Stone and Pebby bands	Precambrian
	——————Thrust and Local——————	
Baila and Gamir Formations (Undifferentiated)	Carbonaceous slates/phyllites	(?) Precambrian
	Limestone and Quartzite	
	——————Murree Trust——————	

Causes of Fagla Landslide

1. There is enough surface water and sub-surface water that drains the rocks of the slide area, making them cohesion less and hence triggering of slide occurs.

2. In the northeast of Fagla area, threr are number of springs where from oozing of water takes place. One soring occurs at Nunkot and the other at Dandhot. Yhere are also many more springs to the extreme north east and one can observe seepages at many places along with waterlogged spots. During rains these add to the debris that gets accumulated at the toe of the Fagla landslide due to action of more water.

3. The landslide develops from incipient movement caused by the various factors, including the loss of vegetal cover, poor soil strength, steep soil and presence of excessive surface for grazing of cattle and removal of firewood from the top of the soil.

Before giving the methods of the control of Fagla landslide, the following discussion is necessary to review the problems faced with this slide, which are entirely different from that encountered in many other landslides along the National Highway –IA between Jammu to Banihal, J & K State.

Discussion

A furious nalla named as Bichlari nalla in a gorge section below, from the base of which raise of retaining walls up to the road is very difficult. This means that toe cutting in case of fagla landslide is dangerous to think of. The slope of the landslide is exceptionally vertical and the road for vehicular traffic is narrow without having any provision for widening the same by toe cutting.

The third problem is about large ingress of water from varios nallas, springs and waterfalls that flow through the rocks in Fagla area. Unless a permanent solution to take huge run off out from the slide area beyond the land slide site, the rocks would continue to slide and mass wastage would never get minimized.

Besides the nallas, there occur many falls usually having a fall of 30m or 40m) percolate through the slide area and thus slope failure results. The rocks at Fagla zone are phyllitic in composition and phyllites are friable than other hard rocks. Thus large ingress of water becomes an active agent to disintegrate the phyllitic rocks, which usually roll down in big blocks and come down on the road. After the debris gets mixed with water due to force of gravity slides downwards and spread itself at the toe portion of the slide. (Hussain and Kitti , 1980; Prasad and Verma, 1980; Singer and Munn, 1987 and Singh, 1991).

The watershed area of Fagla zone is devoid of any forest cover and hence this can be one of the main causes that rocks lose stability. During the preceding decades, there has been unrestrained commercial exploitation of forests by several unscrupulous elements from the Himalayan slopes, resulting in denudation. The bared hill slopes not only present an ugly sight, but also led to soil erosion, frequent landslides, lowering of water table, decrease in rain and snowfall and related climatic changes in the region. Application of the mindset on the problems reveals that forests are important source from which soil underneath maintain soil fertility and also minimize the wastage of the nutrient rich soil to get washed off from vegetational farmyards. Forests are considered to regulate the environmental quality and hence it would be a positive step in this direction to conserve them (Chada 1990 and Aggarwal 1992). The pressure on forests because of human activities such as construction of roads and dams accompanying with mega projects are more severe than the direct influence from submergence.

Forests are closely linked to the life style of the hill prople. Unfortunately, the people have not learnt as yet how much loss is caused due to (Kulhari) axing of forests. It is an immense material loss to the economy of the state. Not withstanding the commendable efforts made by the project BEACON and other agencies, landslide problem along the highway and other surrounding areas has still now eluded a lasting solution and the main cause of it is the deforestation which is mainly occurring in almost all the hilly areas of Jammu and Kashmir State. Thus cutting of forests is the main cause at the grass root level which is responsible for the destruction of the crops on one hand, and landslides on the other hand.

Method of Control

The combination of following methods is suggested for the control of fagla landslide:-

1. The model of Japan is suggested by Tunake (1993) for Kamenose landslide area in Japan is applicable for better control of fagla landslide.

   Drainage tunnels may be taken right from Anokhi water fall. The drainage wells are required to be drilled 3.5 meters in diameter radially here in the run off water would get collected from the upper regions. From these wells horizontal holes 6.6cm in diameter should be made so as to drain water to drainage tunnels which through walls are connected to main central trunk drainage. This central drainage needs further to be bored in the landslide layer below the slip surface. The defector canals then finally take the drainage off the site of the landslide and would thus be made to fall in the Bichlari nalla flowing below the road almost parallel to it (as shown in Fig. 1) of the location map. This method will be best to control the large ingess of water in the fagla landslide area and also suited to the

topographic conditions existing.

2. Resatraining structures, shaft work at vulnerable points in the crown portion of the slide is also needed. Reinforced earth in the crown portion of the slide is alsosuggested to be taken in hand where there are sufficient joints present and the areas where water logging exists.

3. Anchoring at vulnerable points in the crown portions of the slide also would be best suited on the lines suggested by Zaruba and Manel (1969), Hobest and Zojic (1983), Chowdhury (1980).

4. As far as vegetation is concerned, trees with long roots as suggested by Natarajan and Gupta (1980) in the watershed areas will best serve the purpose to control the slide. Moreover, recently vetiver technology is becoming very popular in checking mass wastage in many parts of Himalaya (Lavania, 2000, 2004). Vetiver grass should be grown abundantly in the whole belt from Ramban to Anokhi fall area. It will bind the soil together and will prove helpful in controlling erosion, mass wastage and also contamination in waters (Tikoo, 2004; Fotedar , 2006).

5. There exist presently small breast walls which are incapable of arresting the slide material coming from the crown portion of the slide (Fig.7). The breast walls may be constructed on sound foundation having weep holes and raised to a reasonable height capable of checking the scree material rolling down from the face of the slide.

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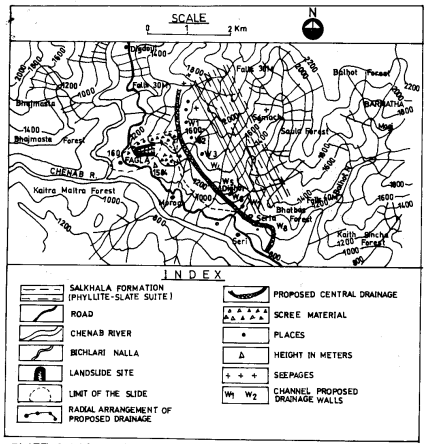

Fig.1: Location map showing Falgla landslide

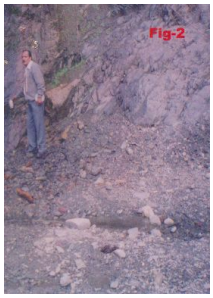

Fig.2: BEACONS

Fig. 3 & 4: Showing gorgers along Bichlari nalla

Fig. 5: Anokhi fall

Fig. 6: Siniking area along which visible fault

Fig. 7: Shooting stone area