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# Golden Research Thoughts

**GRT**

## NORTH -EAST INDIA LANDSLIDE HAZARD AND DEVELOPMENT RELATING TO TRANSPORT NETWORK

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### ABSTRACT

**P**roblem of Environment and development has become a major concern of the world at present. A large number international and global organization with collective wisdom of scientist, economist and planners has come to settle the environmental issues confronting the nations and the physical world. It is accepted that human encroachment has led to the situation of environmental crisis. In this paper an attempt is made to introduce the problem of landslide hazard in transport development in NE India.

Road plays a vital role in spatial integration and development of a region and roadways is one of the most important mode of important mode of transport and development in N.E. India. But the problem is along with the development of road

network in the physiographically fragile hilly parts of the region there crop up landslide hazard and lead to the increase in erosion and depositional activities and ultimately quick depletion of wetlands and other environmental crisis. Now the question is how far we are concern for sustainable development. The road network is must and very urgent for resource utilizations and socio-economic progress in the remote areas of the hilly parts. But due to development of roads, landslide has become so frequent.

Landslide is a down slope movement of rock materials caused by gravity and weight of the materials and soil water. As the roadways are constructed and developed by encroaching the slopes, therefore the gradients are steepen and become more vulnerable to landslide hazard and if necessary measures are not taken in time then the situation will turn in to more Deteriorated and uncontrollable state.

**KEYWORDS** :global organization , scientist, economist and planners .

## INTRODUCTION

The term landslide is using at present collectively for all sorts of mass wasting process, but in real sense landslide is one of the type of different types of mass wasting processes. Geomorphologic ally mass wasting means the down slope movement of weathered rock materials as a direct response to the application of shearing stresses caused by gravity and the weight material and soil water. The entire mass wasting processes depend upon the angle and height of the slope and the presence of the water that loosen the materials and ready to move downslope. depending upon the nature of down slope movement the mass wasting processes are classified in to different categories like (i) creep (ii) solifluction (iii) earth flow (iv) mud flow (v) landslide

Again landslide also occurs in five different ways they are (i) slump (ii) debris slide (iii) debris fall (iv) rock slide (v) rock fall. Interesting fact is that the term landslide has been become so popular that for any instance of down slope movement of rock debris or soil denote by landslide at present.

As a matter of concern that landslide was not recognize to be a natural hazard for long as because its impact is less dramatic in comparison to other natural environmental hazard like flood earthquake, cyclone etc. At present landslide is though recognized to be one of the leading natural hazard in the mountainous areas yet there is no much discussion are appeared among the thinkers, scholar and publish meaningful research paper. Even the common mass also not so aware from the severity, disastrous nature and consequences. The reason behind for the less importance may be on the ground that landslide generally occurs in very smaller areas and a number of human causalities are also less in compression to other natural hazard. But most striking fact is that the frequency of landslide is increasing day by day in higher slopes all over the world I general and the topographically so complicated higher slopes of fragile mountainous part of NE India in particular and the situation seem to be fast worsening in the region.

The NE India occupying an area of 255036 km<sup>2</sup> belong to very rugged topography except the Brahmaputra and Barak and few other small plains accounting for only 28% and the rest 72% are mountainous. Therefore this part is always recognized as a complicated physiographic part of the country. On the basis of the past experience this part is frequently attacked by different natural hazard. Prominent among them are flood, earthquake and cyclone. In respect of flood though officially yet not recognized but it is demanding from different corner to include the region in the most sensitive zone in Indian flood map. Regarding earthquake the region is put in the most sensitive zone and the affect of cyclones also not least but mainly confined in the Brahmaputra valley. Recently the Indian government recognized NE India to be the first sensitive zone in respect of landslide hazard as the frequency of landslide is increasing day by day due to regions physical configuration, tropical humid climate and introduction of number of road networks and process of urbanization etc and ultimately the region is going to take a serious turn.

## CAUSES OF LANDSLIDE:

The extent of landslide depends on the steepness of the slope. The bedding planes of rocks, the amount of vegetations cover and the extent of folding & faulting of rocks. A major causes of which trigger off the landslide is the weight of the overlying materials and the presence of lubricating materials like water. The over bearing weight of the water (may be snow or ice) that has been seep into the soft permeable rocks generally lead to the sleeping and breakage of hill slopes.

Landslide also takes place due to earthquake tremor and by the action of deforestation.

Human often change the natural slopes for construction of roads and building and such changes make hill slide more vulnerable to mass wasting and landslides.

## OBJECTIVE:

Landslide is a natural hazard has turned in to a human induced hazard in a physiographic ally rugged or mountainous region like NE India. So the main objective of this paper is –

1. To analysis the impact of road network on hill slopes where the landslides are very common experience
2. To project the probable affect of landslide both in mountainous and plain part of landslide

## DATABASE AND METHODOLOGY

The landslide hazard is purely localized, occur generally in micro level and frequency of occurrence, intensity and magnitude are not recorded properly and therefore relevant data of landslide are not available. Hence some information are not collected from primary sources and secondary data of road network are used for analysis. Again, along with personal investigation and with the help of simple mathematical calculation I tried to attain at my conclusion.

## INTRODUCTION OF ROAD TRANSPORT NETWORK IN NORTH-EAST INDIA

Road transport is the most vital and basic infrastructure for the 72% of the mountainous part of NE India. The Introduction of road transport was started from the historical past but the developed network was immerging in the British rule. According to the record available there were 320 kms of graveled road and 6400 kms of kutchra road in Assam (United Assam) in 1903-1904. After independence the national government took up plans of building national highways and same such highways came to be building in NE India. According to 1991 report a total of 4393 kms of national highways were complete of which 1361 kms were in Assam and the rest 3032 kms were in the hills and mountains. This figure has been increased in 2011 up to 3333 kms and newly 301 kms are added in the mountainous part and NE India total records 6169 kms. Again the government of India still going to take same new project to remove the in adequacy of road network as region is marching behind the National level.

The above figure is only for national highways but there are also roads constructed and developed under the jurisdiction of respective state government and comprising all, the table reveals the total road length of NE India is 139845 kms and all India total 2465877 kms. If we exclude Assam's figure then the total for the hills state come to 198263 kms.

The road length in actual practice is more than the above figure because there are also road under PMGSY (Prime Minister Gram Sodak Yojona) started from 2001 and roads under DRDA (District Rural Development Agency). But the data of total road length including all is not found.

## THE STUDY AREA

Necessary field study has done in a portion of national highway 62 starting from Wageasi to Wakok for 8 kms and the spot is located 15 kms away from the south of Dudhnoi of Goalpara district, Assam and the spot is in the North Garo hills districts of Meghalaya. The GPS values of t he starting and the ending points are N25°48'09.3 to N25°47'42.1 E90°48'39.1. The road is constructed trough the valley formed by river Dudhnoi known as Manda by Garos.

The area fall in a very sensitive zone in respect of earthquake and had earlier experience a number of earthquakes and a great earthquake of 1897 measuring magnitude of 8.699(+) in the Richter scale claiming hundreds of lives . it is also fall under sub tropical monsoon climate where the entire basin area experiences heavy monsoonal rainfall ranging from 174 cm of 475 cm per year mainly with in the summer months from June to august. There is continuous increase of altitude from Wageasi 267

to Wakok 341 m and the road constructed by encroaching either each side of the slope and at some places both side are cut. The road is further developed and widen in 2012 where it has left some old tracks in order to minimize the sinuosity at the cost of slopes.

Vertical measurements are recorded in 16 successive spots recorded in the side of the slope cut for the construction. The highest points are found to be 25 meters and there are marks of previous landslides.

Unfortunately there are no any official records that listed the past events and so, the exact nature of slide and the volume of debris are not known. The unofficial sources reveal that there is experience at least 2 to3 times of landslide in a year in the peak hours of the monsoon rains when the soils are highly leached. The volume of debris estimated to be 10 to 20 trucks. The area was covered with thick jungles before 20 to25 years ago but now they are naked and most of the areas are used for jhum cultivation which is one of the most sensitive and destructive for environmental degradation and catelite for landslide hazard.

**Table.1.Vertical measurement of the encroached size**

Point	Height of wall (meters)
p/1	25'0
p/2	5'0
p/3	6'0
p/4	7'5
p/5	2
p/6	5'5
p/7	4
p/8	7'5
p/9	2
p/10	5'5
p/11	4
p/12	12
p/13	18
p/14	3
p/15	3
p/16	7

Average height of vertical slope 115/16=7.1875 M

**ESTIMATION OF DEBRIS**

It is estimated that for the construction of just 1km long road requires removal of 40,000 to 80,000 cubic meters of debris. If we multiply this value with the total road length the following total come.

For the construction of national highway of total length of 3333 kms the total volume of debris will be

$$3333 \times 40,000 \text{ cm}^3 = 133320000 \text{ cm}^3$$

$$\text{To } 3333 \times 80,000 = 266640000 \text{ cm}^3$$

If the estimation is made for the whole network including NH, surfaced and unsurfaced then the following figures appear before us.

$$\text{The total road length } 139845 \text{ km total volume of debris } 139845 \times 40,000 \text{ cm}^3 = 559380,000 \text{ cm}^3$$

To  $139845 \times 80,000 \text{ cm}^3 = 1118760,000 \text{ cm}^3$

The above amount of debris is added with the debris of normal erosion process. Again the frequency of landslide per year, especially during peak monsoon period, in NH 62 is 10 to 12 times then for the total route of 139845 kms the yearly frequency may be estimated  $139846/190 = 736$  approx.

One truck =  $10 \text{ cm}^3$

So, 10 trucks =  $100 \text{ cm}^3$

For a frequency of 736, the volume of debris will be  $736 \times 100 \text{ cm}^3 = 73600 \text{ cm}^3$

This is very straight and simple calculation but the actual frequency of landslide may be more because the route of Arunachal Pradesh, MIZORAM AND Nagaland and more vulnerable in comparison to roadways of Meghalaya where the situation is so surprising on the ground that landslides occur even in the dry season.

Now the result is, the very extra amount of rock debris is added with the normal erosion process and the most important problem is the extra volume of debris will not stay in the hills or on mountains, but their ultimate destination is in the plain. Eventually sedimentation rate will be geared up.

### **IDENTIFIED PROBLEMS**

The landslide hazard has created the following environmental problems in north-east India

- a) Huge volume of extra debris load is added with the normal erosion process annually and this leads to increase the normal rate of depositional process in the plain.
- b) The chief cause of rising of river beds (Brahmaputra and its tributaries) is the landslide hazard. This leads to the increase of flood problem.
- c) Extinction of wetlands in the present context is a serious concern for the environmentalists as well as common people. The landslide may be one of the important factors among different factors for quick depletion of number of wetlands in Assam in particular.
- d) Lost of top soil and depletion of physiographic balance in the higher slopes.
- e) There may be human casualties and also recurring additional cost for repairing.
- f) In the study area the down slope part is abandoned because of the probable affect of landslide even not used for agricultural purposes.
- g) The area where once slide becomes more dangerous and vulnerable to slide.

### **CONCLUSION AND SUGGESTION**

Environment and development is a contradictory topic. This paper however, not includes the current stage of socioeconomic development and resource utilization of NE India. The only problem is looked into the landslide hazard in relation to the development of transport network. In respect of north-east India is still behind the national norms. According in 2002 road per 100 sq km is 54.8 while national figure is 74.9, the percentage of surfaced road to the total road is 24.96 while national percentage is 54.68. Again if we exclude Assam, being a state of plain topography then the above level will go far below.

So, development of transport network is an urgent need where road transport is the most viable. But on the other side landslide is creating a serious problem. So, the critical question before us is, whether we shall develop road ways or not?

**Here I want to put just few suggestions.**

1. Avoid encroaching slopes where it is possible.
2. Avoid minimizing sinuous course encroaching slopes.
3. Making necessary terraces where it is possible.
4. Afforestation as well as reforestation should be done at optimum level.
5. Jhuming areas should be shifted from the roadsides.
6. Road should be constructed after much judgment with minimum encroachment into the slopes.
7. Records of landslide should be maintained and even landslides of very small magnitude are also to be recorded properly.
8. Media should play positive role by publishing the actual facts and make necessary awareness.
9. Request to avoid political decisions but scientific decision should be taken for any new projects of roadway development.

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