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REPORT ON THE PRELIMINARY POST DISASTER INVESTIGATION OF LANDSLIDE OCCURRED AT HADGERI VILLAGE IN HONNAVAR TALUK, UTTAR KANDA DISTRICT, KARNATAKA

(Additional Item)

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I.0. 1. 0. INTRODUCTION:

The monsoon showers of 2010 triggered many landslides in Uttar Kannada district, Karnataka. There was media report that a huge landslide has occurred near Hadgeri village in Honnavar Taluk of Uttar Kannada district during September 2010. As per the request from the Deputy Commissioner of Uttar Kannada district, Karwar, with the approval of Dy. DG, GSI, SR, Hyderabad the preliminary investigation was carried out by Engineering Geology Division, GSI, Bangalore. The preliminary investigation of the post disaster study of the landslide at Hadgeri was taken up to assess the nature and causes of the landslides, including the risk and vulnerability at the site.

I.i. LOCATION OF LANDSLIDE:

The landslide near Hadgeri village falls in toposheet no 48 J/12 with co-ordinates 14^0 10' 15.2" N and 74^0 42' 52.1" E and situated at elevation of 201M above MSL.

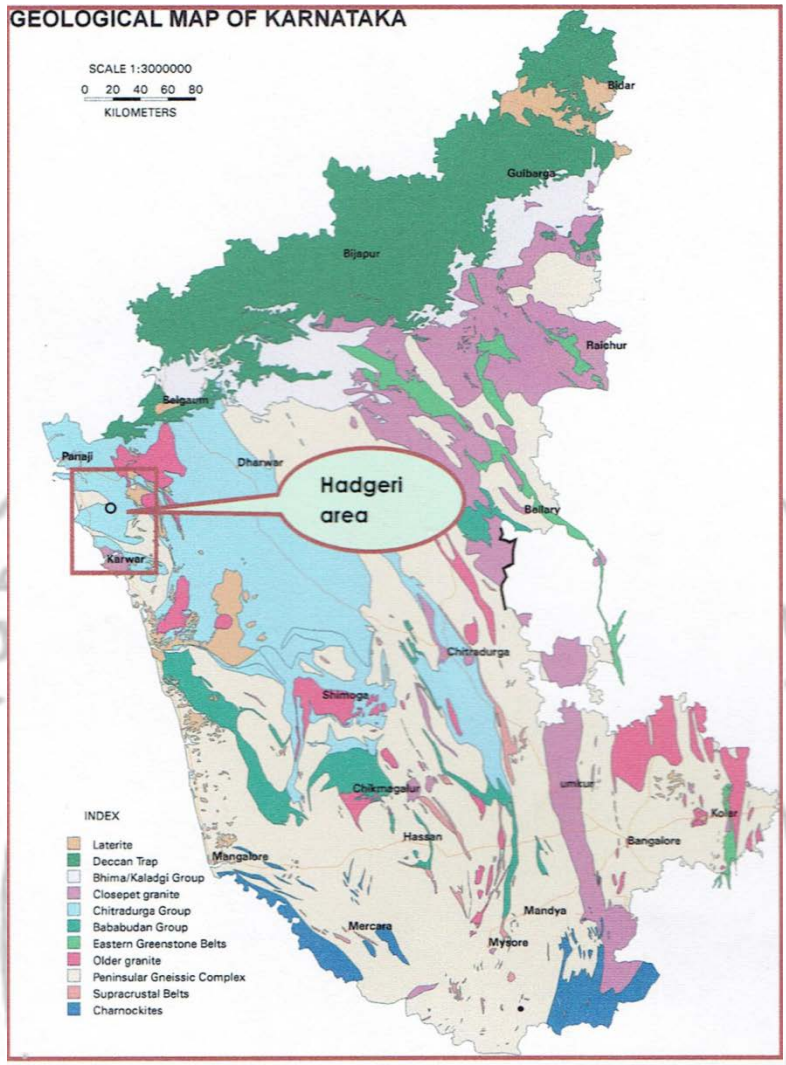

Fig 1: Location map of Karnataka showing Hadigeri Landslide area.

I.ii. ACCESSIBILITY:

The accessibility to the landslide area is very difficult. The slide is located at 22 km from the Gerusoppa dam. The road leading to Hadgeri hamlet is narrow and not suitable for four wheeled vehicles. However the road is accessible up to Galaguru. The Landslide site is accessible by track route stretched for 7 km from the last point of motorable road.

I.iii. LAND USE AND LAND COVER:

The Hadgeri Hamlet consists of 12 villages, having population of about 650. The area is covered by thick forest surrounded by Western Ghats. The area is very backward with areca nut and coconut plantations being the main plantations being the main occupation. The landslide area comes under forest land and the nearest villages from the landslide site are Gerupal and Surimane.

II. GEOLOGY AT THE SITE

The geology at site includes weathered granite/gneiss, acid volcanics, basic dyke and quartz vein in the crown part. The rocks belong to Bababudan group of Dharwar Super Group.

III. SLIDE CHARTERSTICS

The landslide occurred in the forest land. The date of occurrence of slide was not available. Villagers in the downstream of the landslide noticed red muddy water flowing in the nala during August and informed the forest officials. The landslide is classified as reactivated debris flow. The information gathered from the local population that the old slide occurred during 2001. which got reactivated in 2010.The debris flow occurred on the non-perennial nala. The mass debris was carried by stream over a low angle slope surface in the form of a sheet of 1-3 m thick. The run out distance is more than 700-800 m and the direction of the flow is N40UE.

III.I. SLIDE MORPHOMETRY:

a) Length of the slide: ~ 800 m
b) Width of the slide: ~150m
c) Depth of the slide: ~15 m
d) Scarp length: ~150 m
e) Scarp heights 30 m
f) Scarp angle: ~vertidal
g) Run out distance :~ 800 m
h) Slide direction: N40°E
i) Slope prior to failure: 25^0
j) Slope after failure: 15^0 -20^0
k) Type: Reactivated

III.ii. SLIDE MATERIAL:

The slide material in the zone of accumulation and depletion comprises of different fraction debris containing fragments of weathered granite/gneiss, acid volcanics, basic dyke and quartz pebbles. The size of different fractions varies from boulders to cobbles/ pebbles and soil/clay material.

III.iii. LOSS OF PROPERTY:

The slide occurred in a forest land and there is no direct loss to property and life but nearly 6.6 acres of forest land was destroyed and about hundreds of trees were uprooted.

III.iv. RAINFALL:

The investigated area falls in the Western Ghat and receives a high annual rainfall. The rain fall data was collected from the nearest rain gauge station i.e. KPCL station at Gersoppa dam site. As the exact date of occurrence of the landslide is not available it is difficult to ascertain the antecedent rainfall. Antecedent rainfall includes the total rainfall prier to the date of Landslide and it can be analysed taking different combination of antecedent days. The immediate trigger for the slide appears to be the rainfall. The detail of the rainfall data from 1st May 2010 to 18th October 2010 recorded at Gerusoppa dam site rain gauge station is given in table 1 and fig 2.

May-10		Jun-10		Jul-10		Aug-10		Sep-10		Oct-10	
Date	**Rainfall (in mm)**	**Date**	**Rainfall (in mm)**	**Date**	**Rainfall (in mm)**	**Date**	**Reinfall (in mm)**	**Date**	**Rainfall (in mm)**	**Date**	**Rainfall**
1	2.80	1	0.00	1	12.60	1	59.40	1	34.60	1	36.20
2	0.00	2	0.00	2	87.20	2	27.40	2	39.60	2	0.00
3	35.20	3	0.00	3	90.00	3	42.80	3	29.00	3	12.20
4	0.00	4	0.00	4	28.00	4	82.00	4	96.20	4	35.40
5	0.00	5	0.00	5	20.40	5	29.40	5	35.60	5	5.60
6	0.00	6	0.00	6	63.00	6	18.60	6	15.40	6	0.00
7	0.00	7	10.20	7	52.80	7	52.00	7	69.80	7	18.20
8	0.00	8	1.00	8	37.80	8	48.00	8	62.00	8	0.00
9	0.00	9	2.00	9	0.60	9	31.40	9	43.80	9	8.00
10	0.00	10	0.00	10	0.00	10	6.80	10	33.00	10	0.00
11	0.00	11	1.40	11	2.40	11	52.40	11	27.60	11	5.80
12	0.80	12	0.00	12	9.20	12	4.00	12	1.80	12	0.00
13	0.00	13	9.80	13	3.60	13	19.60	13	2.60	13	0.00
14	0.00	14	61.00	14	13.80	14	11.00	14	0.00	14	0.00
15	0.00	15	115.00	15	12.60	15	1.80	15	10.00	15	2.00
16	0.00	16	54.00	16	64.40	16	71.00	16	16.00	16	23.00
17	0.00	17	60.00	17	63.00	17	85.40	17	64.60	17	0.00
18	0.00	18	91.00	18	16.40	18	54.20	18	5.40	18	0.00
19	59.20	19	32.00	19	67.80	19	12.20	19	1.00	19	12.20
20	0.60	20	24.20	20	131.20	20	0.00	20	3.20	20	0.60
21	0.00	21	0.00	21	138.60	21	29.60	21	0.00	**Total**	159.20
22	0.00	22	5.00	22	87.00	22	64.00	22	28.00		
23	0.00	23	43.00	23	36.80	23	4.40	23	0.00		
24	3.40	24	17.00	24	44.00	24	1.00	24	42.80		
25	0.00	25	62.00	25	73.40	25	8.80	25	0.00		
26	0.00	26	130.00	26	116.00	26	33.00	26	1.40		
27	0.00	27	136.00	27	44.00	27	24.80	27	19.40		
28	0.00	28	21.40	28	38.40	28	25.00	28	46.00		
29	0.00	29	0.60	29	121.40	29	15.00	29	18.00		

May-10		Jun-10		Jul-10		Aug-10		Sep-10		Oct-10	
Date	**Rainfall (in mm)**	**Date**	**Rainfall (in mm)**	**Date**	**Rainfall (in mm)**	**Date**	**Reinfall (in mm)**	**Date**	**Rainfall (in mm)**	**Date**	**Rainfall**
30	0.00	30	6.20	30	121.80	30	8.00	30	2.80		
31	0.00			31	187.00	31	161.00				

Table 1: Rain fall data collected from Gerusoppa dam site rain Gauge Station (courtesy KPCL)

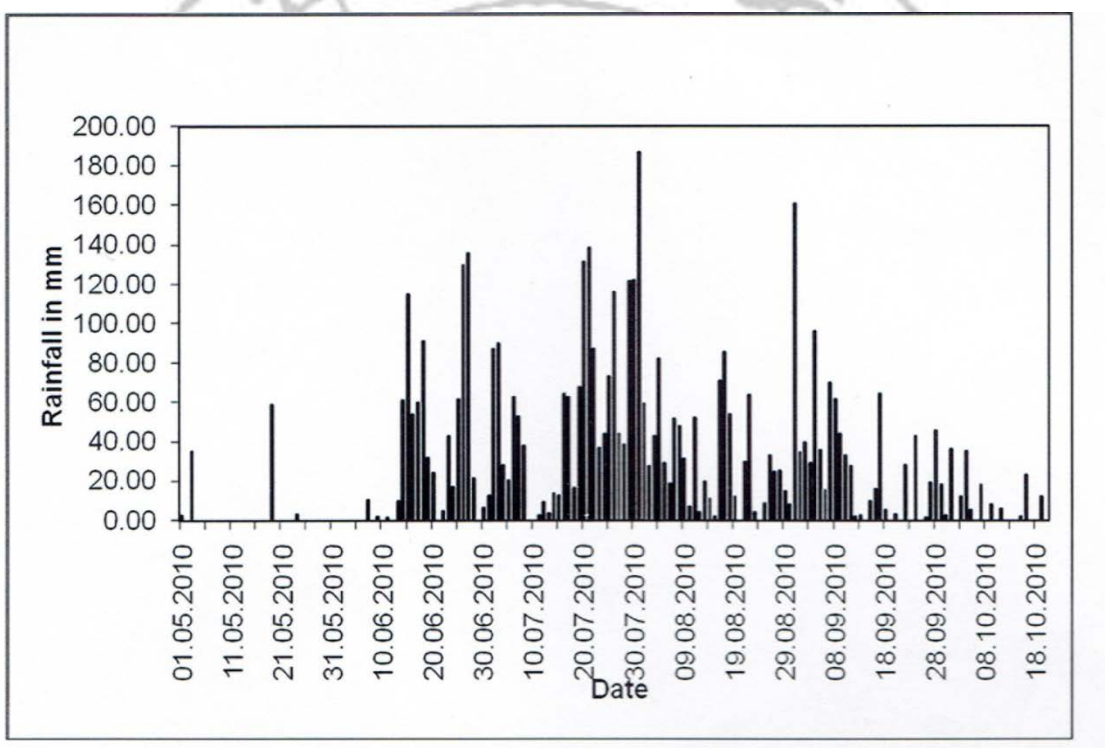

Fig2; Daily rainfall variation between May and October 2010

III.v. CAUSES: The following could be causes of this debris flow:

a. It is a reactivated landslide. The depth of weathering is >20 m. The conversion of weathered granite/acid volcanics (in the crown and zone of depletion) to clay particles viz., kaolinite, montmorlinite. The contact between granite/acid volcanics (as seen in debris) and clay particles might have failed the due to the loss of friction under saturated condition.

b. The displaced material behaved like a viscous mass, which indicates that the intergranular movements have predominated over shear surface movement and thus resulting in a debris flow.

c. The development of high pore pressure due to high clay content (as observed in the debris throughout the valley).

c. High volume of water discharge in to the nala (the nala is non perennial and ground water table is shallow)

III. vi. IMMEDIA TE TRIGGERING MECHANISM:

a. The heavy rainfall during July might have triggered the debris flow. High rain fall/infiltration increased the shear stress on the surface and decreased the shear resistance of the hill slope.

IV. RECOMMENDATIONS:

The corrective measures recommended are as follows.

a. It is difficult to contain the Landside by providing any structural measures by considering the cost involved.

b. It is recommended that the slope may be planted with deep rooted plants like vetriver which can hold the soil together.

c. Proper drainage may be made for the discharge of water from the nala.

d. It is a natural slide and based on the preliminary studies we have not found any evidence that the Llinganmakki reservoir (15 km away) and Gersoppa reservoir(22 km away) have exerted any pressure to cause the slide as reported in certain sections of the media.

e. Detailed study of the area is recommended before taking up any remedial measures. The future study may include officials from the forest and environmental people.

VI. ACKNOWLEDGEMENT

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LIST OF PHOTOGRAPHS

Photo1: Crown, scarp and the zone of depletion of the Hadgeri debris flow.

Photo2: Zone of accumulation of the Hadgeri debris flow.

Photo 3: View of the Hadgeri debris flow from zone of accumulation.

Photo 4: A view of old slide scarp on the right flank of the Hadgeri debris flow.

Photo 5: A view of zone of accumulation and toe part of the Hadgeri debris flow.

Photo 6: A view of zone of accumulation and toe part of the Hadgeri debris flows.

Photo 7: Left flank of the slide in the zone of depletion of the Hadgeri Landslide.

Photo 8: Right flank of the slide in the zone of depletion of the Hadgeri landslide. Old slide scarp is also seen.