

(51)

## Geological Assessment of the alignment corridor proposed from Manan of Takula to Chandrapur length 2.0 Km District Almora.

Priya Joshi

12/09/18

**1- Introduction:-** The Construction Division, Public Works Department, Almora has proposed the construction of 2.0 Km motor road from Manan of Takula to Chandrapur District Almora. On the request made by Mr. B. C. Pant Executive Engineer Construction Division Almora, I carried out the geological assessment of the proposed site of the above said motor road on dated 29.08.2018. Junior Engineer Mr. Kishor Bangari accompanied during the site visit.

**2- Location-** The site in question starts from Km 6.500 which is end point of Manan-Bamanigaad motor road. Total length of the road is 2.0 km which consists of 4 HP bends at 0/9-0/11, 0/15-0/17, 1/13-1/15, 1/20-1/23 cross section respectively. Gradient of the whole road varies as 0/0-0/9 1:24 R, 0/9-0/11 1:40R, 0/11-0/15 1:17R, 0/15-0/17 1:40R, 0/17-0/28 1:24R, 0/28-0/32 LEVEL, 0/32-1/8 1:20R, 1/8-1/13 1:17R, 1/13-1/15 1:40R, 1/15-1/20 1:20R, 1/20-1/23 1:30R, 1/23-1/30 1:20R, 1/30-1/32 LEVEL, 1/32-1/38 1:30F, 1/38-1/40 LEVEL. The co-ordinates of starting taken from hand held GPS are as follows-

**Starting Point**

**Latitude-** 29°44'34.66"N

**Longitude-** 79°35'41.35"E

**End Point**

**Latitude-** 29°44'30.06"N

**Longitude-** 79°36'6.08"E

**3- Geological Assessment:-** The alignment corridor proposed for the above said motor road lies in part of Kumaun Himalaya. Geologically the site in question lies in Almora Nappe of Kumaun Lesser Himalaya. Almora Nappe is bounded by South Almora Thrust (SAT) in South and by North Almora Thrust (NAT) in the North. It comprises rocks of Almora Group. Almora Group comprises of two different lithological units which are Biotite Mica Schist, and Micaceous Quartzite of Saryu Formation and Granite-Granodiorite plutonic bodies.

The site in question comprises of Granitic Gneiss. Granitic Gneiss is compact and hard in strength. The strength of the rock is estimated by manual test. High grade of deformation and weathering is observed at the starting portion. Largely the rocky strata along this alignment are capped by thin overburden material which varies in thickness from place to place and overall less than 1m. Joints are closely spaced and the opening between the joint planes is close to open up to 1-2mm. In-between the opening along the joint plane soil-clay is filled. The soil material has silt content and the matrix is fine to very fine. The soils are good cohesive, dense and hard in dry conditions but these

converts into soft clays under the wet/saturated conditions. Slope direction varies from place to place. Slope angle varies from  $25^{\circ}$ - $50^{\circ}$ .

The topography of the area is moderately steep-gentle. Majority of the proposed road passes through forest; near to the village cultivated terraces were observed. The rocks are slightly- moderately weathered and oxidized up to  $W_1$ - $W_2$  grade. Hydrological conditions in this area are mainly dry in the fair weather. No prominent perennial nala were observed some small ephemeral nala falls along the alignment. Rolled boulders of various sizes are observed in km 1. Four prominent joint sets which were recorded from the Granitic Gneiss outcrop exposed at the site are as follows-

**Table-1**

S.No.	Feature	Dip angle	Azimuth
1	Foliation/J1	$45^{\circ}$	N $180^{\circ}$
2	Joint J2	$50^{\circ}$	N $200^{\circ}$
3	Joint J3	$35^{\circ}$	N $350^{\circ}$
4	Joint J4	$40^{\circ}$	N $280^{\circ}$
4	Slope	$45^{\circ}$	N $270^{\circ}$

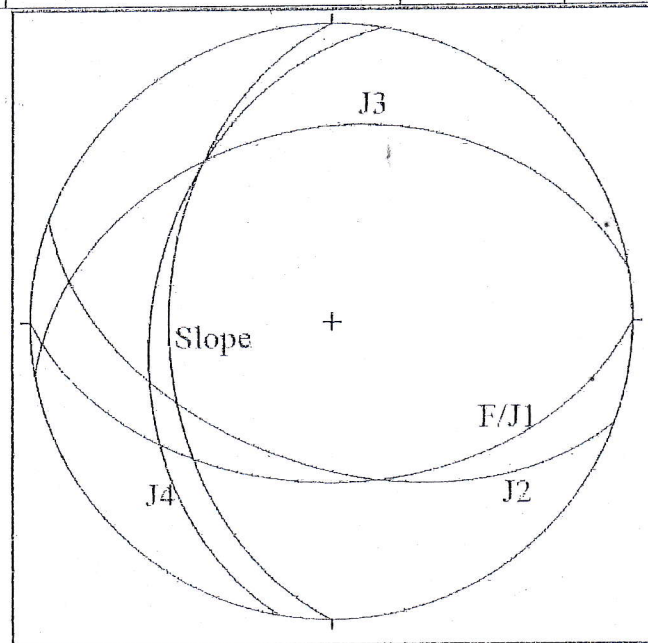


Figure Stereographic projection of joints and slope data recorded from the outcrop.

From the above stereographic projection it is clear that joint J4 dips in slope direction which is forming planar failure condition at given location along with a wedge is also forming due to the intersection of J2 and J3 and dips in slope direction thus failure can occur; if any joint or tension crack acts as a releasing surface.





Figure 2 General topography of the site



Figure 3 View of planting point comparing of slope landslide depth

On the basis of the geological/geotechnical studies carried at the site and the fact mentioned above the following recommendations are being made for the construction of the proposed road, failing to these recommendations this report will be treated as cancelled.

#### 4- Recommendations-



(50)

- 1- Do not blast heavily by explosives. It is recommended that the blasting shall be carried out by controlled method i.e. by leaving large volume of dummy holes.
- 2- The entire hill and valley side slope along the whole length of the road must be protected by suitably designed retaining/ breast walls. This work should be done simultaneously with the advancement of the road cutting. It is advised to leave sufficient weep holes in the walls; this is so as to facilitate the subsurface drainage.
- 3- Properly designed culvert/causeway/bridge must be constructed over the nala whichever is suitable.
- 4- Construct extra-large lined drain all along the hill side of the road and made adequate cross drainage arrangements. The accumulated rain water from upper reaches of the hill must not allow to flow freely over the road constructed and its lower hill slopes.
- 5- Disposal of muck and excavated waste on the lower slopes of this road is to be strictly avoided. It is advised to dispose the muck on the identified site for muck disposal.
- 6- The portion of the road which passes through the cultivated field where water seepage from the ground is high; RCC should be done.
- 7- Gradient of fourth HP bend at 1/20-1/23 cross section must be improved to 1:40. All the HP bends must be constructed with standard gradient and protection must be given on the hill side to retain the slope.
- 8- At cross section 0/28-0/32 manual cutting should be done as the slope forming material is loose comprising of old landslide deposit which can fail. Protection must be given to prevent failure anywhere along the alignment during and post construction.
- 9- All the construction activities must be carried out as per the prescribed norms and the standard codes of the practice laid by BIS and MORTH.

Letter No: 4320/02 संभूवै/18

Date: 12/09/2018

कोरो प्रति कृतपित

सहायक अभियन्ता,  
निर्माण विभाग, डी.डी.आर.  
अल्मोरा

Priya Joshi

Priya Joshi  
(Assistant Geologist)  
Chief Engineer Office  
PWD, Almora.

## प्रपत्र-35

परियोजना का नाम:- जनपद अल्मोड़ा के विधानसभा क्षेत्र सोमेश्वर के विकासखण्ड  
ताकुला के अन्तर्गत मनान से चन्द्रपुर तक लिंक मोटर मार्ग का नव निर्माण  
(लम्बाई 2.00 किमी०)

**Task Force Certificate**

- (i) Lay out of the Land-be followed as far as possible.
- (ii) Heavy cutting/filling be avoided-as far as possible. The technology of cut and fill method is to be adopted. Steep hill slopes also to be avoided.
- (ii) Unstable/slide-prone areas to be avoided. For identifying such areas the advice of Geotechnical engineers and geologists to be taken during the survey for alignment.
- (iii) Comparison of various possible alignments with reference to erosion potential be made and the alignment involving minimum erosion risks be preferred. Apart from the stage of planning the road alignment, effective steps are also required to be taken by ground engineer during the process of road construction for minimized ecological disturbance to the hill roads Broadly the measures to be taken have been identified as :-
- (i) Cut and fill method to be adopted while excavating for road formation and heavy earth cutting is to be avoided Box cutting is to be avoided to the extent possible.
- (ii) Blasting by explosives is to be restricted to the minimum. Lay out of holes to be drilled for blasting is to be planned keeping in view the line of least resistance and the existence of joints Controlled blasting should be repeated using low charge and care be taken to avoid activating slide zones or widening fissures and cracks in road. Use of delay detonators in large scale blasting work is to be made for anaoline dispersion of chock waves, so that minimum disturbance is caused to the rock stratum as a result of the blasting process.
- (iii) All cut slopes, unusable hill side and slide prone erosion prone areas are to be provided with suitable correction measures by using one or the other of the techniques developed by CRRI. Several techniques have been sponsored by CRRI. like simple vegetative turning, bitumen muck treatment and slide treatment by jute netting coir netting of these simple vegetative turning seems to be the most appropriate preventive measure in many situations. This should be established in the denuded slopes immediately after the excavation is made.
- (iv) Adequate drainage measures and protective structures like intercepting catch water drains, longitudinal drains/culverts, breast walls, retaining walls are to be provided for purpose of establishing the slips Growth vegetative cover is to be stimulated in the disturbed hill slops above the road level by planting suitable fast growing shrubs and plants. In
- (v) Over the past few years the roads wing of the Ministry of Shipping and transport has issued instruction laying down broad guidelines and check list of the preparation of road construction projects which provide an inbuilt mechanism of tackling land slides/erosion control for the guidance and follow up action by engineers of state 'PWD' Border Roads Organization and others engaged in construction of hill roads. these should be observed.

प्रमाणित किया जाता है कि योजना आयोग द्वारा गठित टास्क फोर्स द्वारा प्रदत्त उक्त संस्तुतियाँ का परियोजना के निर्माण के दौरान अनुपालन सुनिश्चित किया जायेगा हैं।

(नीरज कुमार)  
कनिष्ठ अभियन्ता,  
निर्माण खण्ड, लो०नि०वि०,  
अल्मोड़ा

(जे०सी०पाण्डे)  
सहायक अभियन्ता,  
निर्माण खण्ड, लो०नि०वि०,  
अल्मोड़ा

(आशुतोष कुमार)  
अधिशारी अभियन्ता,  
निर्माण खण्ड, लो०नि०वि०,  
अल्मोड़ा