Geological Assessment of Kasardevi (Tiwarikhan) to Maath 2.50 Km District- Almora.

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1- **Introduction**- Construction Division, Public Works Department Almora entrusted in construction of 2.50 Km Kasardevi (Tiwarikhan) to Maath motor road District-Almora. On the request of Shri S. D. Pandey Assistant Engineer, Construction Division, Almora I carried out geological assessment of the above said motor road on dated 19/07/2018. Junior Engineer Shri K.S. Patwal accompanied during the site visit.

2- **Location**- The Kasardevi(Tiwarikhan) to Maath motor road starts from Km 5 of NTD-Kafarkhan motor road. The sanctioned length of the motor road is 2.5 Km but after survey total length of the alignments is coming 3.050km which consists of 4HP Bend at 0/17-0/18, 0/31-0/32, 1/31-1/32 and 2/23-2/24, cross-section respectively. Gradient of the whole road varies as-0/0-0/6 1:16F, 0/6-0/8 1:14F, 0/8-0/11 1:10F, 0/11-0/12 LEVEL, 0/12-0/13 1:60F, 0/13-0/15 1:24F, 0/15-0/16 1:18F, 0/16-0/18 1:40F, 0/18-0/19 1:16F, 0/19-0/20 1:60F, 0/20-0/21 1:24F, 0/21-0/22 1:40F, 0/22-0/23 1:60F, 0/23-0/24 1:40F, 0/24-0/25 1:16F, 0/25-0/26 LEVEL, 0/26-0/27 1:18F, 0/27-0/30 1:17F, 0/30-0/32 1:40F, 0/32-0/34 1:18F, 0/34-0/37 1:17F, 0/37-0/40 1:14F, 0/40-1/1 1:18F, 1/1-/2 1:17F, 1/2-1/3 LEVEL, 1/3-1/4 1:60F, 1/4-1/5 1:40F, 1/5-1/6 1:20F, 1/6-1/8 1:24F, 1/8-1/9 1:14F, 1/9-1/10 1:20F, 1/10-1/11 1:12F, 1/11-1/20 1:17F, 1/20-1/30 1:18F, 1/30-1/32 1:40F, 1/32-1/40 1:18F, 1/40-2/2 1:40F, 2/2-2/10 1:18F, 2/10-2/20 1:20F, 2/20-2/22 1:18F, 2/22-2/24 1:40F, 2/24-3/2 1:18F. The co-ordinates of starting and end points taken from hand held GPS are as follows-

Starting Point	**End Point**
Latitude- 29°38'19.824"N	**Latitude**- 29°38'40.525'N
Longitude- 79°39'53.161"E	**Longitude**- 79°40'10.180"E

3- **Geological Assessment**- The alignment corridor proposed for the above said motor road lies in part of Kumaun Lesser Himalayan. 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.

Topography of the area overall is gentle to moderately steep. Starting portion of the area is very steep upto 0/11 cross section. Starting portion is mostly covered with forest than the last few km's which falls on the terraces from where the road will pass. Slope angle varies from place to place. Slope angle varies from 25°-50°. Hydrological

conditions are mainly dry, except in rainy season. No prominent nala is observed along the alignment. Rock type is micaceous quartzite, which is hard and compact in strength. The strength of the rock is estimated by manual test. At some places the rock is highly sheared and weathered. In between Quartzite; Schist is also observed which is weak in strength. In Schist high grade of deformation is observed. In micaceous Quartzite joints are closely spaced and the opening between the joint planes is close to open up to 1mm. In-between the opening clayey soil is filled. Largely the rocky strata along this alignment are capped by thin overburden material which varies in thickness from place to place. Soil cover is less than 1 m and has clay content.The soil is good cohesive, dense and hard in dry conditions but these converts into soft clays under the wet/saturated conditions.

Table-1

S.No.	Feature	Dip angle	Azimuth
1	Foliation/J1	10°	N 120°
2	Joint J2	35°	N70°
3	Joint J3	15°	N10°
4	Slope	25°	N 90°

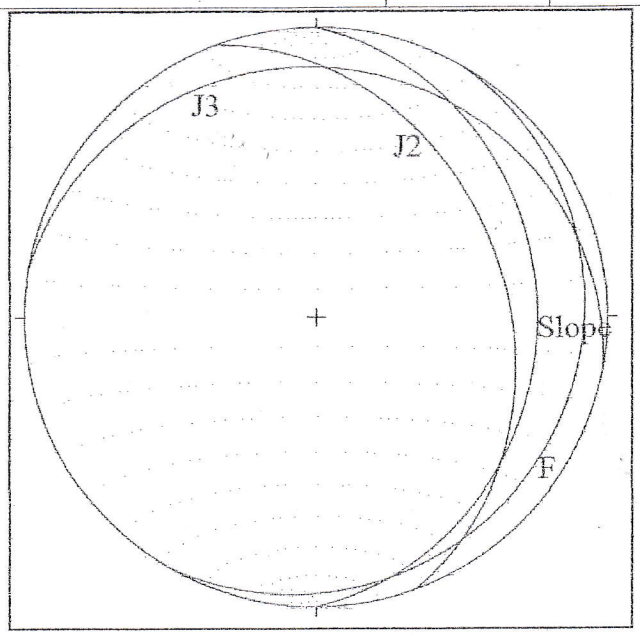

Figure 1 Stereographic projection of joints and slope data in micaceous quartzite

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

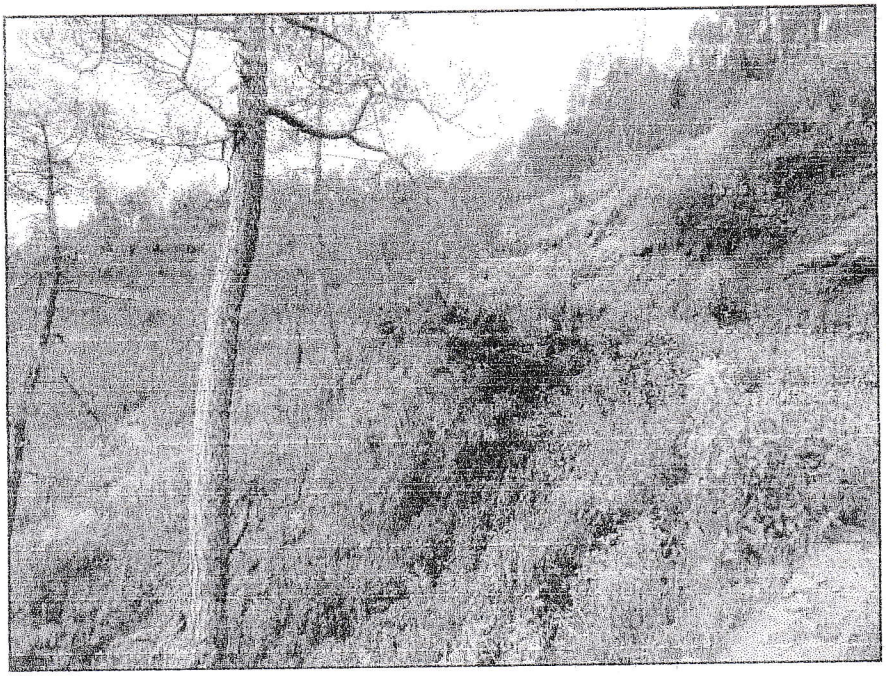

Figure 2 General topography of the area

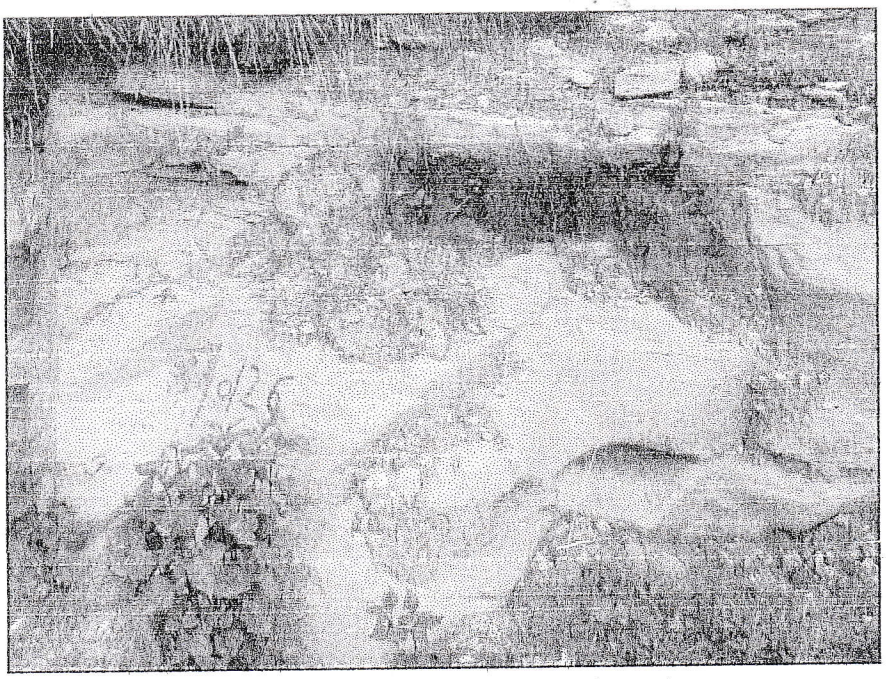

Figure 3 Micaceous Quartzite outcrop observed

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-

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- All the HP bends must be constructed with standard gradient and protection must be given on the hill side to retain the slope.

8- Protection must be given up to 0/11 cross section as the slope is very steep and the gradient is very low at the starting point; protection must be given to prevent failure anywhere along the alignment during and post construction.

9- At some portions of the road gradient is very low 1:10, 1:14, 1:16; if possible which should be increased. At the starting point the gradient of road should be increased.

10- 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.

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