

कार्यालय प्रमुख अभियन्ता एवं विभागाध्यक्ष  
उत्तराखण्ड लोक निर्माण विभाग,  
देहरादून।

गर्भीय निरीक्षण आख्या एस0जी0- 171/सड़क/पुल समरेखण/कुमाऊ/2014

Geological Assessment of the alignment proposed  
for Sarna to Malidhari motor road, Distt. Almora.  
(Link Route)

15-अप्रैल-2014

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## Geological Assessment of the alignment proposed for Sarna to Malidhari motor road, Distt. Almora.

Vijay Dangwal

15.04.2014


**1- Introduction:-** The PMGSY Division, Salt has proposed the construction of 10.03 km motor long motor road namely Sarna to Malihari motor road in District Almora, under the Pradhan Mantri Gram Sadak Yojna (PMGSY). On the request of Shri.C.P. Singh, the Executive Engineer, I carried out the geological /geotechnical assessment of the proposed alignment corridor on 06.04.2014 in presence of Er. R.P. Pande, Asstt. Engineer and Er. N.C. Tamta, Add. Asstt. Engineer.


**2- Location:-** The alignment proposed for Sarna to Malihari motor road lies in Bhikyasain Tehsil, Distt. Almora.

**3- Geological Assessment:-** Sarna, Malihari, Bhikyasain and their surrounding environs geologically falls in the Kumaon Lesser Himalayan Belt bounded by South Almora Thrust to north and Main Boundary Thrust to south directions. Mostly the rocks of Ramgarh Group i.e. chloritic and schistose phyllites associated with the quartz porphyry which are thrust under the rocks of Almora Nappe are exposed in and around the area of the proposed alignment. A NW-SE trending fault plane runs from Bhatronj-Bhikyasain through Tamadhaun is a remarkable local tectonic feature of this area and its effect is clearly marked on the rocks exposed in this area. The bed rocks are exposed at fewer sections of the proposed alignment corridor otherwise large part of it is covered by the overburden material comprised of composite having thickness as high as 10.0 m order. The quartz porphorided exposed on the alignment slopes are generally massive, hard, compact and thickly bedded while the phyllites are thinly foliated and weak in physical competency. The former member is less altered as compared to the phyllites as it contains mineral quartz instead of platy and flaky clay minerals. At places the rock masses are sheared and shattered in nature and have been dissected by four prominent joint sets.

By and large the slope facets between CH. 00.00 to CH. 01.250 km are inclined at steep angle measured at the site upto  $70^{\circ}$ . Generally these slope faces are oriented N 170 direction which remains almost sunny and dry in all weather conditions. Largely this reach of the alignment is comprised of the strong rocks which

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सहायक अभियन्ता  
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at places are overlain by the thin sheets i.e. 0.5m-1.0m, of overburden material. The "Uniaxial Compressive Strength" of the rock masses exposed in this section has been estimated ranging between 50 M Pa to 100 M Pa. Two prominent joint sets, the Joint Set No.1-  $45^{\circ}$  /N 030 and joint set No. 2-  $70^{\circ}$  /N 195 intersects each other to form adverse structural wedges dipping outwards to the slope faces therefore, the entire stretch between CH. 00.00 to 01.250 km of the proposed alignment needs safe excavation using controlled blasting. *While excavating the slopes by drill blast technique, it must be assured the after every blast the impression of the intact half drill mark are visible on the bed rocks and only half of the drill hole is extracted.*

The alignment corridor between CH. 01.250 and CH. 05.350 km passes across the slopes inclined at low to moderate angle ranging as high as  $30^{\circ}$  in more or less in N 090 direction. Mostly the slope facets across which this segment of proposed alignment passes are comprised of the schistose phyllites which are soft and overlain by the thick cover of residual soils generated by decompositions of these bed rocks. These soils contain highly cohesive clay minerals in abundance along with good amount of detrital quartz which exhibits high values of cohesion (c) and internal friction ( $\phi$ ). This overburden material is stiff to very stiff i.e. "Undrained Shear Strength" 300 K Pa to 500 K Pa. only in the dry state. On the contrary to this property these soils are soft soils under the wet/saturated conditions. Such soils slopes are highly susceptible for slope failure under the saturated conditions. *Therefore, adequate drainage arrangements must be made in this section of the proposed road, in addition to the sealing of the entire surface of the road must be sealed in order to check the infiltration of water into the sub surface material.*

The slopes between CH.05.35 km to CH. 07.00 km are inclined at  $65^{\circ}$  in N 170 direction and the stability of these slopes is controlled by the master joint sets. The slope facets at this section are covered by the thin sheet of overburden material. *In this section the road must be formed by half cut half fill methods.*

Onwards from CH. 7.00 km to CH. 09.83 km stretch the ground across which the alignment passes is comprised of thick envelope of mixed soils which are dispersive, granular and semi consolidated in nature. *In this section the thickness of WBM is required to be double than the normal and the proper drainage must be made. Sealing of the entire surface of the excavated road bench is strictly recommended.* The road here can be made either by walling or half cut-half fill techniques.

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The last 200 m stretch of the proposed alignment passes across the slopes formed of highly dispersive soft soils. Any type of anthropogenic activity in this section will threat the stability of its upper slopes and arms of the proposed road. This end 200 m part of the alignment was geologically not found feasible for the construction of road.

By and large the slopes of the proposed alignment are free from any mass waisting activities.

These slopes across which the alignment passes are thinly forested and are partially covered by the scanty Chir forest.

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

#### 4- Recommendations:-

- 1- Form the road by the controlled drill blast method and half cut half fill techniques in the respective sections, described above. The loose fill must be compacted by dynamic compaction only.
- 2- Seal the entire surface of the road bench by black top immediately after the excavation this is so as to check the water infiltration into the subsurface soils.
- 3- Construct extra wide lined drain all along the hill side of the proposed road and make adequate arrangements for cross drainage.
- 4- Do not dispose the drained water on the loose/dispersive/soft ground.
- 5- Do not dispose the excavated waste on the lower slope, otherwise it will threat the stability of the lower slopes.
- 6- Protect the entire road by constructing the suitably designed retaining walls.
- 7- All the construction activities should be carried out as per the norms and Standard laid by the MORTH/ BIS codes for the Construction similar Structures.
- 8- The 200 m end chainages i.e. from 9.83 to 10.03 km of the proposed road are not suitable for the construction of motor road, therefore must be left version without any activity.

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