


Geological assessment of the alignment corridor proposed for the construction of 23.00 km (sanctioned length=25 km) long Shivpuri-Hadisera-Jajal double lane motor road, in NarendraNagar block, dist. Tehri Garhwal.

1- Introduction:- The Construction Division, Public Works Department, Narendranagar under CM declaration no. 305/2014 and GO no. 1730(1)/III(2)/14-03(मु०म०घो०)/2014 dated 24.09.2014 has been instructed for the construction of 25.00 km long double lane motor road namely Shivpuri-Hadisera-Jajal motor road. The work of survey has been carried out where two alternative alignment has been proposed named alignment 1 and alignment 2. The alignment 1 and 2 having length of 23.00 km, both originates from km 15 of Rishikesh-Badrinath NH-58 (nearby Shivpuri) across the hill slope of the mountainous stretch which ultimately connect to km 23 of Rishikesh-Uttarkashi-Harsil NH-34. The alignment 1 acquire comparatively less reserve forest area number of bypass bridges than in alignment 2, therefore alignment 1 is recommended for further geological study. Considering above, Er. Sahab Singh Saini requested to the undersigned for the geological assessment of the above mentioned alignment in response to which I carried out the same on 07.07.2022 in the presence of Er. Nitin Saini, Addnl. Assistant Engineer, PWD, Narendranagar, dist. Tehri Garhwal.

2- Location:- The 23.00 km long alignment corridor of this road originates from km 15 of Rishikesh-Badrinath NH-58 (nearby Shivpuri) across the hill slope of the mountainous stretch connecting more than 6 villages like Hadisera, Raundeli, Matiyala, Shivpuri, Pasar Kyark and Dhaigala which ultimately connect to km 23 of Rishikesh-Uttarkashi-Harsil NH-34, in NarendraNagar block, dist. Tehri Garhwal.

3- Geological Assessment:- Geologically, the alignment corridor of the proposed road falls in the Outer Belt of Garhwal Lesser Himalaya and it stretches between the two hamlets namely Jajal and Shivpuri located on the NH. 34 and NH. 58 respectively. This segment containing the alignment corridor is bounded by the Shrinagar Thrust (ST) in the north and the Main Boundary Thrust (MBT) in the south direction. A prominent fault namely Nagni to Shivpuri runs parallel to this alignment and river Heval flows more or less along this tectonic plane. The terrain containing this alignment is characterized by the river valleys bounded by the hill slopes on its either directions. The topography of this stretch is rugged and dissected and a number of small stretches of surfacial mass movement activities have also been recorded in this areas. This alignment corridor up to cross section 10/18 passes along the right bank slopes of river Heval and thereafter it goes along the left bank upto its end chainage. The rocks of Damta, Nagthat, Chandpur and Shubatu Formation are exposed in this area which are represented by the quartz, arenites, quartzites, phyllites and shales respectively. The cross slopes of this alignment are inclined at moderate to steep angle and largely these are covered by the thin sheet of overburden material. The rock masses exposed in this area exhibits a wide range of physical competency and these are slight to partially weathered and oxidized in nature. The quartzites are


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least altered along this alignment corridor while the shales, slates and phyllites have been partially altered by the physical as well as chemical weathering. According to an investigation carried along the alignment corridor the geotechnical parameters recorded are given the following table.


Geotechnical Parameters

1	Rock Type	Chandpur phyllite, Nagthat quartzite, dolomites, shale and slate
2	Weathering Grade	Dominantly moderately weathered(W_2-W_3)
3	Joints	3-4 sets of joint
4	Uniaxial Compressive Strength	Phyllites= 30 M Pa -50 M Pa Massive phyllites= 50 M Pa -200 M Pa Quartzites= 50 M Pa -250 M Pa Dolomites= 20 M Pa -150 M Pa Shale/Slates= 30 M Pa -100 M Pa
5	RQD	Phyllites= 30% -45% Quartzites= 45% -50% Dolomites= 45% -61% Shale/slates= 22% -30%
6	RMR	Phyllites = 21-40 (poor) Quartzites = 41-60 (Fair) Dolomites = 41-60 (fair) Shale/slates = 0-20 (Very poor)

It has been observed that the in-situ rocks exposed along the alignment are traversed by four prominent linear discontinuities which exhibits long persistence and widely spaced, at places thickly jointed in nature. All the joint sets are tight and sometimes they are infilled and sealed by the secondary inclusions. The details of these joints are given in the following table.

Table

S.No	Feature	Dip angle	Azimuth
1	2	3	4
J ₁	(So bedding joint)	25 ⁰	N310
J ₂	joint	70 ⁰	N070
J ₃	joint	54 ⁰	N210
J ₄	joint	80 ⁰	N110


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River Jajal is a perennial river and its course is wide and narrow below the alignment corridor which indicates that the rock masses at places are highly susceptible for chemical weathering under the influence of water and at places they resist weathering activities. It has been observed that the frequent fluvial terraces along with the river born terraces are formed on the either banks of river Heval and most of the human settlement has been taken place on and around these terraces. In case of the construction of this road these geomorphological features must be taken into the account in order to construct a stable road. The stretches where the river course is wide the rock masses along the alignment is highly fragile and soft in physical competencies excessive excavation of hill slopes in these stretches will lead to the hill slopes instability.


The overburden material deposited on the cross slopes of this alignment is comprised of the angular rock fragments of various sizes embedded in the sandy-silty -clayey matrix. This material is naturally fully compacted and hard and dense in physical characteristics. It has been observed that the stretches having good amount of plastic clays is susceptible for the ductile deformation under the wet/saturated conditions, otherwise in dry state these soils deposited across this alignment corridor are "stiff" and "heavy soils" for all engineering purposes.

By and large, the alignment slopes are stable and presently free from any major landslide/mass wasting ground subsidence activities.


On the basis of the geological inspection of the site studies carried and the facts given above, the following recommendations are being made for the construction of the proposed road failing to these this report will be automatically treated as cancelled.

4- Recommendations:-

1. Construct the road by box like cutting full excavation techniques but the mountainous stretch with steep hill slope, carry out the work by half cut and half fill technique and compact the fill material properly by dynamic compaction.
2. Do not blast the rocks heavily, controlled blasts must be done leaving large volume of dummy holes.
3. The either side slopes of the entire road must be protected by suitably designed retaining walls/ breast walls, this work shall be carried out simultaneously with the advancement of the road cutting. This is very important for the stability of the hill side slopes.
4. The entire surface of the road from outer edge to inner edge must be sealed immediately after the excavation, this is so as to check the water infiltration into the sub soil, otherwise the slope will fail.
5. Construct extra large lined drain all along the hill side of the road and make adequate cross drainage arrangements. The accumulated rain water run-off from this road and its upslope catchment should not allow to flow freely over the lower hills.
6. Do not dispose the excavated waste on the lower slopes, it will damage the entire down hill slopes and villages located below it.
7. All the construction activity must be carried out as per the standard codes of practice laid by the BIS and MORTH.


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5- Conclusion:- On the basis of the geological/geotechnical studies carried out at the site and with the above recommendations, the alignment 1 was found geologically suitable for the construction of 23.00 km (sanctioned length=25 km) long Double lane motor road namely Shivpuri-Hadisera Jajal motor road originating from km 15 of Rishikesh-Badrinath NH-58 (nearby Shivpuri) across the hill which ultimately connect to km 23 of Rishikesh-Uttarkashi-Harsil NH-34, in NarendraNagar block, dist. Tehri Garhwal.

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