CHAMPAWAT BYPASS

1. Introduction

Champawat and Pithoragarh districts are situated in the Kumaon Division, and lies in the eastern part of Uttarakhand. Earlier, Champawat was a part of Pithoragarh district and was created when the Uttarakhand State was formed. District Champawat and Pithoragarh plays important role from strategic point of view as both shares international boundary with Nepal. Trading and commerce between Nepal and India takes place on daily basis by both districts.

Due to the strategic importance town like Champawat, Lohaghat and Pithoragarh had developed and habitation grown very fast. To maintain the balance of quick transportation and communication government had planed to reduce the traffic load of those town and simultaneously make new bypass road for rapid services of goods and public transports. As all the bypass roads will be passes through the hill slope hence, it is utmost importance to investigate the geologically unstable slope to safeguard the people and material safety.

2. Vulnerability of the Study area:

The areas are prone to severe earthquakes, landslides and mass movement. In addition, the areas are also affected by disaster like fire, hailstorm, lightening, road accidents, etc. The areas are particularly prone to Earthquake and landslide hazards, as the towns are falls in the highest seismic risk zones of the country i.e. Zone V and IV. As shown in the map Pithoragarh fall completely in Zone V (representing damage risk of ≥ IX on MSK scale), while Lohaghat and Champawat falls partially in Zone V and partially in Zone IV (damage risk of VIII on MSK scale)

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3. Regional Geology:

Geologically, Champawat, Lohaghat and Pithoragarh comprises of diverse rock types. The geological set up is very complex due to the repeated tectonic disturbances caused by different orogenic cycles. The rock succession exposed in the area mainly falls in two groups namely, Ramgarh and Almora Group of rocks apart from the Siwalik Group of Tertiary rocks at the southern side, which is Late Tertiary to Quarternary, exposed all along the foothill belt of the Sub-Himalaya.

The Ramgarh Group is separated by the Main Boundary Fault (MBF) from Siwaliks, which consists of Bhimtal, Bhaindoli, Maula and Swala Formations. The rock types of Ramgarh Group are purple to pale green quartzite with interbeds of greenish grey phyllite, Metavolcanic rocks, streaky gneiss, chlorite schist with sericitic quartzite and metabasites, schistose quartzite and limestone with calc-phyllites. The Almora Group consists of Salla, Gorakhnath, Gumalikheth formations along with the Champawat granodiorite. The major rock types are pale green to cream coloured quartzite with chlorite schist, phyllite, metabasitic rocks, garnetiferous biotite mica schist with interbeds of quartzite, augen gneiss with paragneisses and few orthogniessic interbands, black carbonaceous phyllite alternating with black fine grained, biotite-rich greywacke, garnetiferous mica schist and micaeous flaggy quartzites. The grade of metamorphism increases from south to north.

The Garhwal Group of rocks exposed different parts of Pithoragarh. The rocks of Garhwal Group comprising shale, slate, phyllite, quartzite, dolomite, limestone, magnesite, occasional calc slate and metavolcanics constitute the major part of study area. These rocks are further classified under Pithoragarh and Berinag Formations. The Chiplakot and Askot Crystallines exposed in the study area are granitoid (biotite granite gneiss) intrusives in the Garhwal Group. It comprises of two different ages, the older intrusive dating 1900 Ma and other 1200 Ma. Quaternary sediments are deposited as river terraces, glacial deposits and along the hill slopes as slope wash material. The terrace Alluvium exposed is characterized by well sorted and rounded cobble and pebbles of gneiss and schists in sandy matrix. Basically this is river borne material (RBM) deposited on either banks of the rivers at different levels.

Structurally, the rocks of Garhwal Group have suffered intense deformation, folding and faulting. There is a prominent east west trending anticlinal axis south of Kanalicchina cutting across the Ramganga River. In the southern part of study area, lies the northwardly dipping North Almora Thrust separating rocks of Almora Crystallines and the Garhwal Group.

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Generalised litho-succession of the area has been presented as under;

Group	Formation	Member	Lithology	Age
Recent Alluvium	Channel Alluvium		Grey sand silt and clay	Holocene
	Terrace Alluvium		Angular clasts of gneisses, schists amphibolite and limestone embedded in clay matrix	
Garhwal	Berinag		Quartzite interbedded with metavolcanics, gneisses and slates	Meso-Proterozoic
	Pithoragarh	Upper	Dark grey calcareous slate and limestone	
		Lower	Stromatolite bearing dolomitic limestone, calcareous phyllite, quartzite and marble	

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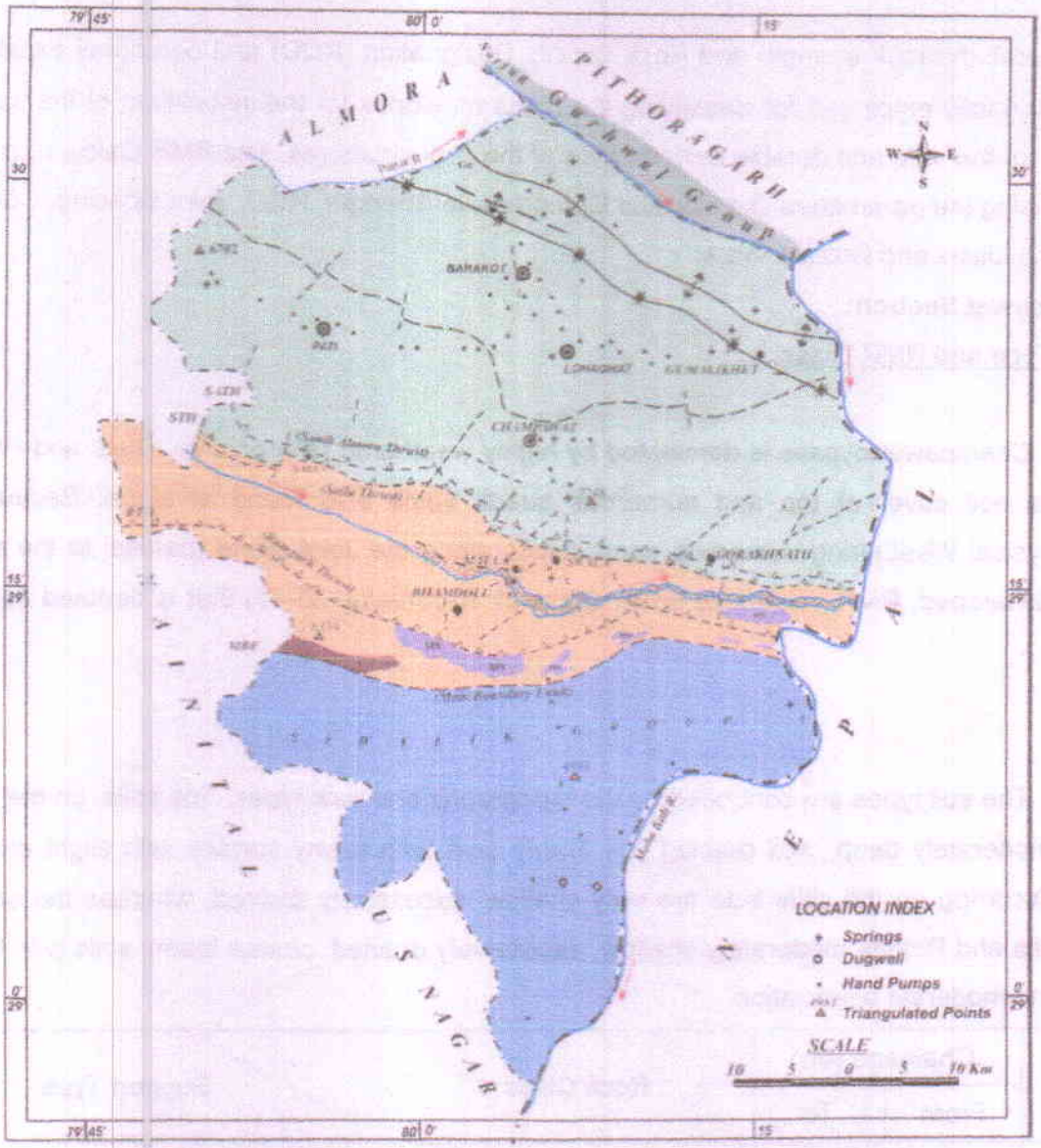

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Slopes and Rock Classes for Protection Measures

In general the rock strength and Rock Quality Designation (RQD) and personnel experience are predominantly employed for classifying the rocks on slopes for the installation of the support elements for the safe and durable performance of the rock structures. The RMR Calculation has been done using the parameters like Uniaxial Compressive Strength, RQD, Joint Spacing, Conditions of Discontinuities and Ground Water.

Champawat Section:

Rock Type and RMR Class:

Champawat bypass is dominated by highly weathered Granodiorite, Slate and Phyllite with residual soil cover at top and numerous quartz veins also found at slope. Because of hydro/Physical Weathering numerous open cracks along the Joint plane (parallel to the slope) has been developed. RMR value falls under Class-III to IV(value 35-45) that is denoted as poor rock type.

Soil:

The soil types are controlled by the topography and rock types. The soils, on the fluvial valleys, moderately deep, well drained fine loamy soils with loamy surface with slight erosion. The soils occurring on the cliffs side are very shallow, excessively drained, whereas the soils on the Summits and Ridges moderately shallow, excessively drained, coarse loamy soils with loamy surface and moderate association.

Sr. No.	Chainage (M)		Rock Class	Support Type
	From	To		
1.	0.00	2200	Overburden soil and Class-IV rock	100 mm thick two shotcreate layer with wire mesh and Breast wall
2.	2200	3500	Slope wash material and Class-III to IV rock	Gabion wall with anchor (SDA) and Top drainage system
3.	3500	4000	Class-III to IV rock	rock bolt with high strength netting system
4.	4000	6800	Class-III rock	Ring net with DT mesh Rockfall netting on cut slope
5.	6800	7800	slope wash and Class- IV rock	100 mm thick two shotcreate layer with wire mesh and Breast wall or netting system

Note: The above support system will be applicable if the cutting height is more than 7 m with steeper slope angle

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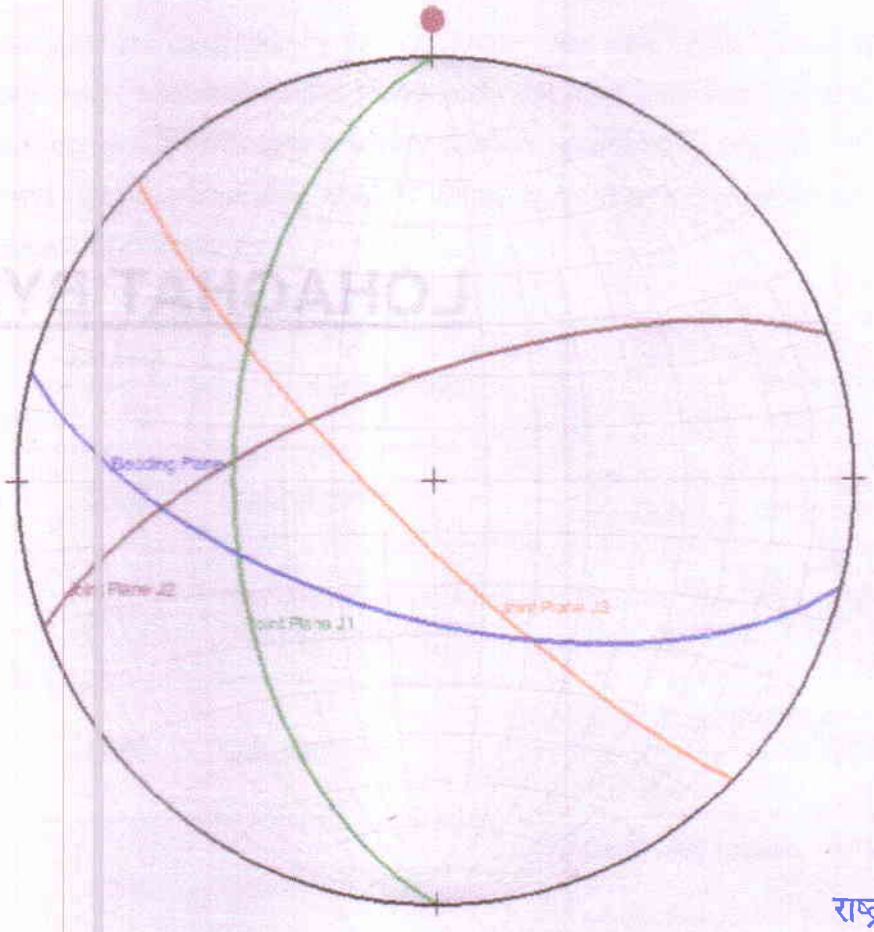
Photo 1 & 2: Exposed Granodiotite Rock at Champawat Bypass section.



Stereonet Plot of different structural parameters of the exposed area of the Champawat section.

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