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**GEOLOGICAL STABILITY REPORT OF LAND IDENTIFIED
FOR THE CONSTRUCTION OF BUILDING FOR THE FIRE OFFICE AT BANJAR**

In hilly areas, the buildings have to be constructed on sloped topography and require comprehensive planning, site selection and design for slopes and sustainable concrete construction practices. Due to the paucity of land availability in hilly areas, it is very difficult to find suitable land for building constructions. Building constructions on slopes needs different architectural forms and configurations, which are guided by many factors in hills such as unpredictable geological situations, precarious climatic variation, hydrogeological conditions, orientation of buildings and sites, slopes and earthquake resistant considerations etc. Unfortunately, these factors are not given due importance as non-engineered construction is in practice. This is increasing, the risk of failures and damage to buildings and hill slopes causing loss of human life and property. Thus, there is an urgent need for engineered construction concerning the height of buildings in hills that mainly evolves out from topography, architecture, climate and disaster, and preparing guidelines for planning and designing buildings.

A request was received from The Commandant, Home Guards, 7th Company, Banjar, Tehsil Banjar, District Kullu, regarding a geological report of 0.1739 hectares of Land identified for the construction Building for the fire office at Banjar. at Tapri. A letter vide letter no. Home(H.C)Kullu-FP/HP/Others/145712/2021-1314 dated 14-March-2024 was received by the undersigned with a request to visit the said site and to give a Geological Report to the concern so that further action in the matter could be taken. Accordingly, the undersigned visited the site along with the officer/officials from the concerned Home Guard department on 04.04.2024

GENERAL OBSERVATIONS

The site under question is located just other the side of Banjar town and the downhill side of the proposed/under construction Banjar-Bypass road. The area is about 23-24 km from Aut and is approximately 53 kilometres from the District headquarters Kullu. The area is well connected by the National Highway and further by a small road of approximately 300 meters bifurcating from the Aut-Banjar-Sainj National Highway. It has been observed that the entire area under observation comprises of overburden or slope wash material and No rock formation was observed near the site under question.

Geologically, the area under investigation exposes rocks of the Rampur Group with Banjar Volcanics formations. The Rampur Group presents an association of meta basalts and metasediments dominated by clastics. It tectonically transgresses over the younger Larji Group of plat formal type carbonate rocks along a major thrust. The Rampur Group is divisible into three formations. These are the Bhallan Formation, the Banjar Volcanic Formation and the Manikaran Formation.

Lithostratigraphic classification of Rampur Group (Modified after Sharma, 1977)

| <u>Formation</u> | <u>Lithology</u> |
|---------------------|---|
| Manikaran Formation | Intrusive granitoid Grey and white massive quartzarenite, locally bands of metabasalt |
| Banjar Volcanics | <i>Mainly metabasalts as dark green phyllite. Interbeds of white massive quartzite and grey phyllite.</i> |
| Bhallan Formation | Slates, greenish phyllite schists with interbeds of white flaggy quartzarenite |

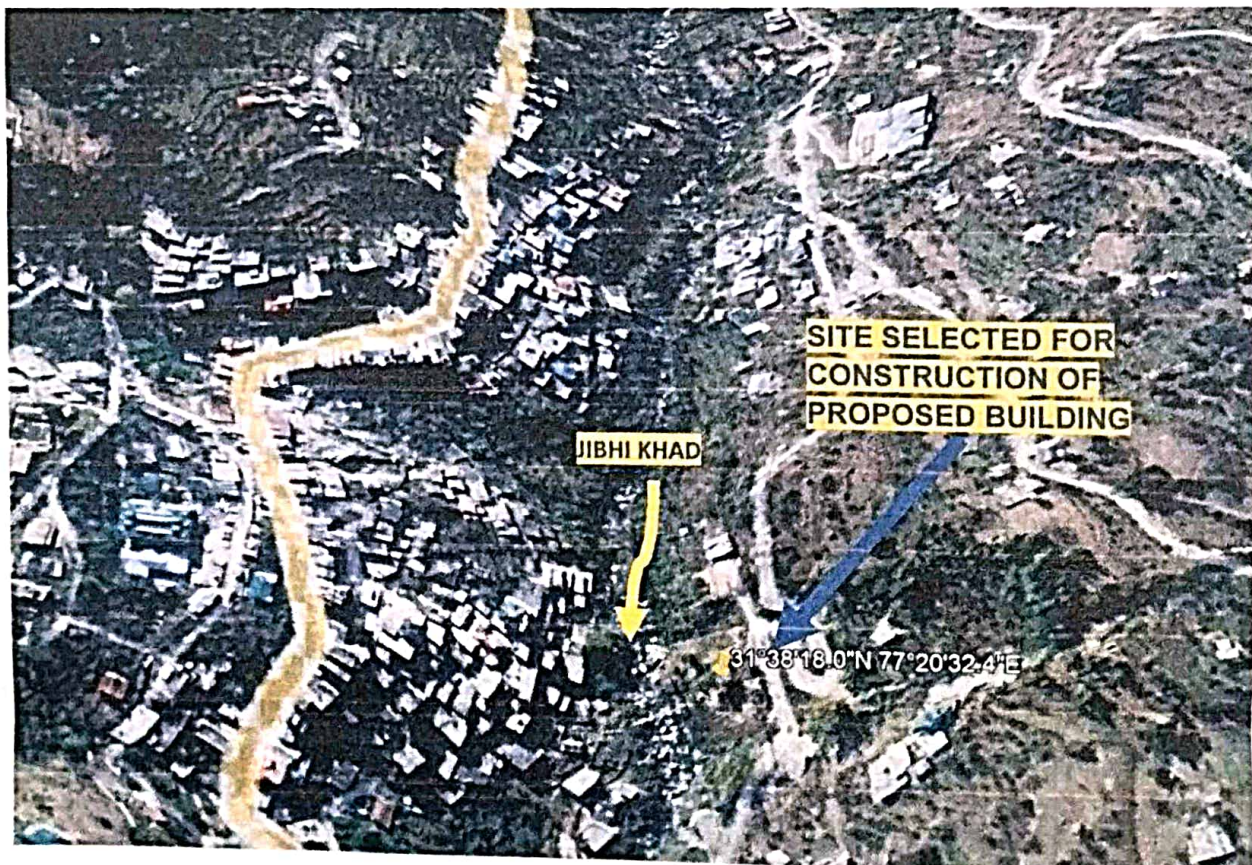
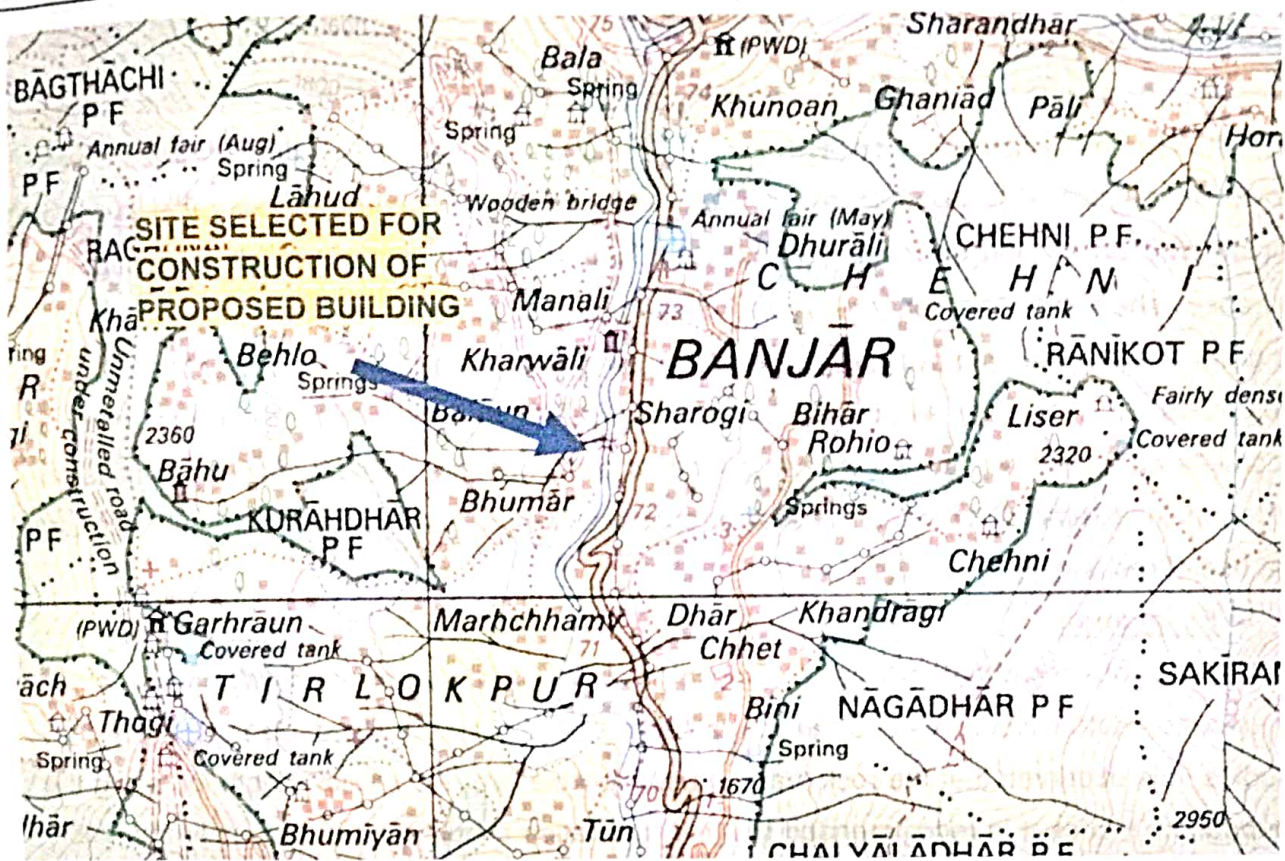
Bandal - Jeori - Wangtu Gneissic Complex

Banjar Volcanics (Green Bed Member)

The Banjar Volcanics (Green Bed Member) Comprises of thick sequence dark green phyllites representing metabasalts. These green stone rocks are well-exposed around Banjar. White massive quartzites and grey phyllites occur as interbeds within metabasalts. Vesicles and amygdulites are well preserved in many sections. Amphibole and plagioclase constitute the main mineral assemblage. Opaques are common. Biotite, tremolite-actinolite, Epidote are also seen more commonly in schistose rocks. The metabasalts mainly represent continental tholeiites.

After the inspection of the proposed site, the following observations have been taken in consideration:-

1. The area under investigation falls under the Survey of India Toposheet No. H43F6. It is located at 31°38'18.0"N 77°20'32.4" E and has an average elevation of 1400-1390 meters at the site.
2. The terrain of the site is largely sloping having an angle of 40-45 degrees with moderate slopes towards the downhill side and covered with the unconsolidated slope wash as well as road-cutting dumped material. The said area where muck has been dumped projects a sloping topography and the precise depth of rock can be obtained only after subsurface investigation of the area.
3. A perennial water channel i.e. Jibhi Khad has about 80 sq.km of catchment area flowing downhill side of the said chunk of land. The area is prone to moderate to heavy rainfalls which could result in flash floods and debris flow from the uphill side due to its peculiar geomorphic and Geological conditions in the Jibhi Khad catchment area. It is expected that during heavy rains the excessive water flow in the Khad could directly hit the toe portion and there may be a chance of toe erosion along the said land and there is a chance of landslide hence, the site needs to be protected before the construction of the Buildings.



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RECOMMENDATIONS

After inspection of the site, it is observed that due to the scarcity of developable space in the hilly regions construction on available surface or land has increased in the recent past, However in general practice to avoid these sites for building constructions. The buildings constructed on sloping surfaces transmit their load to the hill slope through foundations. It increases shear stress, which may cause instability of hill slopes.

In order to carry out construction activities, the hill slope needs to be stabilized. The uphill as well as valley side strata are covered with overburdened material and no insitu rock mass is encountered/ observed, So the following recommendations/ suggestions may be considered, which include removal of loose material, proper drainage, both surface and sub-surface and the use of restraining structures.

➤ Excavation

It was observed that the ground surface below this portion is covered with a thick mantle of unconsolidated loose material, which is resting on the rock surface. Based on the field studies, it is observed that the rock mass is not available over the shallow depth for laying the foundation, Hence it is recommended that the foundation should be laid deep over the stable rock mass, however, if the rock mass is not available at desired depth the foundation and building structure should be designed properly as per the topography and soil stability of the area.

➤ Retaining Structures:

As already mentioned a perennial water channel i.e. Jibhi Khad flowing downhill side of the said chunk of land has a large catchment area. During the rainy season there is always a chance of flash floods in the said Kahd hence the down hillside area of the said land needs to be protected in a suitable manner. A suitable protection work in the shape of Reinforce cement concrete retaining (RCC) from the upstream side should be erected along the water channel. The retaining walls constructed along the river channel must have deep foundations in order to minimize the chance of toe erosion. Weep holes should be provided along the retaining wall in order to allow the free drainage of underground water.

➤ Building Structures:

As mentioned earlier the proposed building will be constructed in the Hill Slope area, hence it is further recommended that high-rise structures should be avoided and the foundation and building should be properly designed in consultation with the structural design experts.

➤ **Afforestation**

Afforestation involves the planting of low-height deep-rooted plantations along the slope should be adopted to reduce surface runoff. It also prevents mass wasting or surface soil erosion.



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