Petrographic, geotechnical and structural investigation of Sher Dara dam site, Swabi, Khyber Pakhtunkhwa, Pakistan

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The igneous rocks around Sher Dara village, Swabi, NW Pakistan are the southeastern extension of the Ambela granitic complex of Peshawar plain alkaline igneous province (PPAIP). The area is a potential dam site for the construction of a small dam and is under consideration of the relevant authorities. The present study encompasses petrographic, geotechnical studies of the foundation and abutment rocks and structural geology of the surrounding area. A correlation of the petrographic characteristics of the mentioned rocks with their mechanical properties has also been attempted.

A detailed petrographic investigation both in hand specimen and thin section leads to a three-fold sub-division of the studied granitic rocks in the area. These include: alkali granite, granite and microporphyritic granite. Geotechnical tests including determination of unconfined compressive strength, unconfined tensile strength, water absorption capacity, specific gravity and porosity were carried out. On the basis of results obtained from UCS and UTS tests, all the studied samples fall in the category of very strong rocks and can provide a suitable foundation for building an engineering structure like a dam. Correspondingly, the values of their specific gravity, porosity and water absorption are within the range permissible for their use as construction material.

A detailed investigation reveals that petrographic details such as grain size, presence of discontinuities, features suggestive of grain boundary recrystallization and intra-grain deformation play an important role in affecting geotechnical properties of rocks. It has been observed that the role of grain size in determining geotechnical properties is more as compared to the other petrographic features.

Topographic map, on which geology of the area has been plotted, was prepared at 1:12800 scale. The joints on both the abutments of the dam were studied and mapped. A cross section was drawn along the dam axis to decipher the behavior of the surface features in the subsurface.

Geotechnical properties of the rocks in the abutments and foundation of the dam site and the structural geology reveal that the area is feasible for the construction of a small dam. However, the granitic rocks at the site have closely spaced joints. Furthermore, the area falls in the high intensity zone of the seismic hazard distribution map of Giardini et al. (1999). Hence in order to avoid any hazard, appropriate precautionary measures must be taken in designing and constructing the proposed dam structure.