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Relationships Between the Petrophysical and Mechanical Properties of Rocks and Shear Wave Velocity

Authors : Anamika Sahu

Abstract : The Himalayas, like many mountainous regions, is susceptible to multiple hazards. In recent times, the frequency of such disasters is continuously increasing due to extreme weather phenomena. These natural hazards are responsible for irreparable human and economic loss. The Indian Himalayas has repeatedly been ruptured by great earthquakes in the past and has the potential for a future large seismic event as it falls under the seismic gap. Damages caused by earthquakes are different in different localities. It is well known that, during earthquakes, damage to the structure is associated with the subsurface conditions and the quality of construction materials. So, for sustainable mountain development, prior estimation of site characterization will be valuable for designing and constructing the space area and for efficient mitigation of the seismic risk. Both geotechnical and geophysical investigation of the subsurface is required to describe the subsurface complexity. In mountainous regions, geophysical methods are gaining popularity as areas can be studied without disturbing the ground surface, and also these methods are time and cost-effective. The MASW method is used to calculate the Vs30. Vs30 is the average shear wave velocity for the top 30m of soil. Shear wave velocity is considered the best stiffness indicator, and the average of shear wave velocity up to 30 m is used in National Earthquake Hazards Reduction Program (NEHRP) provisions (BSSC,1994) and Uniform Building Code (UBC), 1997 classification. Parameters obtained through geotechnical investigation have been integrated with findings obtained through the subsurface geophysical survey. Joint interpretation has been used to establish inter-relationships among mineral constituents, various textural parameters, and unconfined compressive strength (UCS) with shear wave velocity. It is found that results obtained through the MASW method fitted well with the laboratory test. In both conditions, mineral constituents and textural parameters (grain size, grain shape, grain orientation, and degree of interlocking) control the petrophysical and mechanical properties of rocks and the behavior of shear wave velocity.

Keywords : MASW, mechanical, petrophysical, site characterization
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