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Integrated Geophysical Approach for Subsurface Delineation in Srinagar, Uttarakhand, India

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Abstract : The application of geophysical methods to study the subsurface profile for site investigation is becoming popular globally. These methods are non-destructive and provide the image of subsurface at shallow depths. Seismic refraction method is one of the most common and efficient method being used for civil engineering site investigations particularly for knowing the seismic velocity of the subsurface layers. Resistivity imaging technique is a geo-electrical method used to image the subsurface, water bearing zone, bedrock and layer thickness. Integrated approach combining seismic refraction and 2-D resistivity imaging will provide a better and reliable picture of the subsurface. These are economical and less time-consuming field survey which provide high resolution image of the subsurface. Geophysical surveys carried out in this study include seismic refraction and 2D resistivity imaging method for delineation of sub-surface strata in different parts of Srinagar, Garhwal Himalaya, India. The aim of this survey was to map the shallow subsurface in terms of geological and geophysical properties mainly P-wave velocity, resistivity, layer thickness, and lithology of the area. Both sides of the river, Alaknanda which flows through the centre of the city, have been covered by taking two profiles on each side using both methods. Seismic and electrical surveys were carried out at the same locations to complement the results of each other. The seismic refraction survey was carried out using ABEM TeraLoc 24 channel Seismograph and 2D resistivity imaging was performed using ABEM Terrameter LS equipment. The results show three distinct layers on both sides of the river up to the depth of 20 m. The subsurface is divided into three distinct layers namely, alluvium extending up to, 3 m depth, conglomerate zone lying between the depth of 3 m to 15 m, and compacted pebbles and cobbles beyond 15 m. P-wave velocity in top layer is found in the range of 400 – 600 m/s, in second layer it varies from 700 – 1100 m/s and in the third layer it is 1500 – 3300 m/s. The resistivity results also show similar pattern and were in good agreement with seismic refraction results. The results obtained in this study were validated with an available exposed river scar at one site. The study established the efficacy of geophysical methods for subsurface investigations.

Keywords : 2D resistivity imaging, P-wave velocity, seismic refraction survey, subsurface
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