Surface Wave Techniques for Determination of Subsurface Anomalies & its Use in Assessment of Damage and Integrity of Coal Mine Structures

Sanjay Rana[1]

[1]PARSAN, New Delhi, INDIA

ABSTRACT

The presence of subsurface anomalies, such as cavities, faults, unknown tunnels, etc., either natural or man-made, can cause public safety hazards. The detection of these features requires the development of new methods. Among the other surface geophysical methods, Seismic surface wave technology is a suitable geophysical approach for in-situ measurements of mechanical properties of a medium based on the dynamic information of Rayleigh waves when they propagate in a medium. Multichannel Analysis of Surface Waves (MASW) technique & Refraction Micro-tremor (Re-Mi) technique have been widely used in rock and soil characterizations & the same can be utilized for Shallow depth deposited Coal/Lignite characterization also. Seismic Refraction Survey, Resistivity Imagine Technique & GPR technique are found as suitable techniques to map sub-surface structures up to 100m and some time provides up to greater depth by making some modifications in the field geometry. Depth of investigation can be extended up >100m when Field geometry will be modified in the case of Refraction seismic survey using P- wave to know P-Velocity of the sub-surface formation.

The damage & integrity of mine structures, such as the roofs, ribs, face and supporting pillars, is difficult to assess beyond the exposed surface. To mitigate potential rock fall hazards, the geophysicists are assessing the usefulness of Rayleigh wave dispersion analysis to detect damage and stress-relieved zones in mine structures. Flooding & subsidence are another serious problem and best example of damage in mining industry. They are closely related to the cost and the safety of mines. These situations occur, when cracks & fissures created during mining operation.

GPR can be used to find potential water-bearing crack, fracture zones & faults. Both seismic &Resistivity Imaging Technique have been identified in detecting abandoned mines in many coal mines of Australia, U.K, China, Canada & USA.

Present paper presents potential of these methods for solving various coal mining related problems.