

PREDICTION OF WATER-BEARING BODIES IN TUNNELING WITH SURFACE-TO-UNDERGROUND TRANSIENT ELECTROMAGNETIC METHOD

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Water-inrushing hazards frequently happen in tunneling process. In order to ensure safe, economical and effective excavation, prediction of water-bearing bodies is an essential work for tunnel construction. Because transient electromagnetic method (TEM) is sensitive to low resistivity bodies, it has been widely applied in detecting water-bearing bodies on the surface and in underground space for tunneling. Nevertheless, TEM solely on surface or solely in underground cannot satisfy the technical requirement for high-precision detection of water-bearing bodies for the safety of tunneling process. So we propose a surface-to-underground transient electromagnetic detection method (SUTEM) that deploys the transmitting source on the surface and receives the signals in the underground tunnel. This method possesses the advantages of both the surface and underground TEM and overcoming their shortcomings. We first describe the method for predicting water-bearing bodies in front of tunnel face with SUTEM in tunneling. To test the validity of this method we present the simulation of the response characteristics to different anomaly models. And then we introduce a practical engineering case on predicting water-bearing goafs in front of tunnel face in a coal mine and to verify the effectiveness of SUTEM for water-bearing body prediction. Finally, we conclude the whole research by restate the major findings and argue that SUTEM will play more important roles in the future for the warranty of safety of underground space construction.