

OBSERVE CONFIGURATION STUDY OF INDUCED POLARIZATION FORWARD PROSPECTING IN TUNNEL BORING MACHINE TUNNELING

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Tunnel boring machine (TBM) tunneling is susceptible to geological anomalous zone ahead of tunnel face such as fault zones, karst body, water bearing zones. There is an important significance to ascertain the geological conditions in front of tunnel face. Induced polarization method is a geophysics technique which can be used for forward prospecting in TBM tunneling. This method has been widely applied in many engineering fields including mineral location, groundwater exploration, drilling and blasting tunnel detection. But it has not been well-established in TBM tunneling because of the complex environment of TBM excavation. Firstly, the electric field is serious influenced by the enormous metallic body of TBM behind tunnel face. Secondly, there is nearly no space for prospecting due to TBM occupying the whole tunnel space. An observe configuration that can overcome these complex environments is the basis of TBM induced polarization forward prospecting. We propose a forward electrical field focused sounding observe configuration for hard rock TBM, which is composed of focused power supply on tunnel face and the mobile power supply on side wall. Calculation model is established in the TBM tunnel environment. For power supply on tunnel face, various combination forms of supply electrodes and shield electrodes are designed, and the focused effect of the front electric field is calculated by finite element modeling of different electrode combinations. For the mobile power supply, the anomalous body responses of power supply electrodes in different motive lengths and intervals are simulated. By considering the structure and construction characteristics of TBM tunneling comprehensively, the electrode combination of this observe configuration which satisfies the demand of abnormal body response and engineering is optimized. Based on the observe configuration, a measuring system is devised to realize induced polarization forward prospecting in narrow observe space of TBM tunneling.