Large Deformation Control Technology for Tunneling Through Complex Variable Soft Rock (Postprint)

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Abstract

The Juji Tunnel of the Linta Expressway traverses complex and variable highly weathered, thin-bedded shale strata. The surrounding rock is inherently weak and fractured, exhibiting severe large deformation post-excavation, poor overall stability, and high deformation potential for initial support due to substantial burial depth, extensive loosening zones, and strong accumulated strain energy within the strata. To ensure construction safety, deformation of soft rock in adverse geological conditions was controlled through measures including enhancing support structural performance and stiffness, providing reasonable deformation allowance, implementing advanced pre-support and multi-layer support, employing short-bench mechanical rapid excavation, controlled blasting, and regulated cyclic advance. The application of advanced support effectively controlled surrounding rock deformation in soft rock sections, increased the construction safety factor, ensured project quality, and provides technical support and reference for similar tunnel projects.

Full Text

Preamble

Large Deformation Control for Tunnels Traversing Complex and Variable Soft Rock Strata

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Abstract

The Juji Tunnel of the Lin-Da Expressway traverses complex and variable, highly weathered, thin-layered shale formations. The surrounding rock is in-

herently weak and fractured, leading to severe deformation following excavation. The overall stability of the rock mass is poor, and due to substantial burial depth, extensive loosening zones, and strong accumulated strain energy within the formation, the initial support system exhibits significant deformation potential.

To ensure construction safety, comprehensive measures were implemented to control deformation in these poor geological conditions. These included enhancing the load-bearing capacity and stiffness of the support structure, providing reasonable deformation allowances, employing advanced pre-support and multi-layer support systems, utilizing short-bench mechanical rapid excavation methods with controlled blasting, and controlling cycle advance length. The application of advanced support technology effectively controlled surrounding rock deformation in the soft rock sections, increased the construction safety factor, ensured engineering quality, and provides technical support and valuable reference for similar tunnel projects.

Keywords: complex and variable; weak; poor stability; initial support; surrounding rock deformation

Note: Figure translations are in progress. See original paper for figures.