Time-Dependent Analysis of Load Reduction Effect of High-Fill Cut-and-Cover Tunnels Considering Backfill Creep Behavior: Postprint

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Abstract

To clarify the influence of backfill material creep performance on earth pressure above high-fill open-cut tunnels when employing relatively low-compacted loess (RLC) for load reduction, the finite difference software FLAC3D was utilized to analyze the load reduction effect of the RLC layer under conditions where the backfill exhibits significant creep performance (loess) and insignificant creep performance (gravel). Furthermore, the long-term influence of variations in the width, height, and position of the RLC load reduction layer on vertical earth pressure above high-fill open-cut tunnels was investigated. The research results indicate that the creep performance of the backfill material exerts a significant influence on the time-dependent effectiveness of the RLC load reduction layer, with the RLC layer achieving superior load reduction effects in backfill materials with insignificant creep performance. Upon completion of backfill placement, the RLC load reduction layer effectively reduces vertical earth pressure on the tunnel crown by increasing the relative vertical displacement of the backfill above the tunnel. Post-construction, if the backfill is loess, settlement of both the RLC load reduction layer and the backfill increases continuously with time, earth pressure on the tunnel crown increases with time, and the load reduction effect of the RLC diminishes with time. Conversely, if the backfill is gravel, only deformation of the RLC load reduction layer increases with time, earth pressure on the tunnel crown decreases with time, and the load reduction capacity of the RLC increases with time. Additionally, the long-term influence of geometric parameter variations of the RLC load reduction layer on earth pressure above high-fill open-cut tunnels is closely related to the creep performance of the backfill material, and optimal values exist. These results provide valuable reference for long-term load reduction of high-fill open-cut tunnels.

Full Text

Preamble

The source text for this section has been corrupted beyond recovery and contains no translatable content. Consequently, all mathematical placeholders, character encoding artifacts, and fragmented symbolic elements have been omitted, as they constitute meaningless data that cannot be reconstructed into coherent academic prose.

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