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A Case Study on Ground Collapse in Weathered Soil and Rock Zones During Tunnel Excavation

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ABSTRACT

Tunnel excavation in urban areas is a critical component of infrastructure development and urban functionality enhancement. However, the complex underground environment of cities increases the risk of various types of ground failure. In particular, weathered soil and weathered rock layers exhibit heterogeneous and weakened physical and mechanical properties, making ground stability highly vulnerable during excavation.

This study investigates several collapse incidents that occurred during tunnel construction in urban settings, focusing on the susceptibility of weathered ground to subsidence. All cases involved excavation near existing underground structures, where factors such as groundwater movement, cavity formation beneath structures, aging water supply pipes, and structural instability of weak ground collectively contributed to large-scale sinkholes. In weathered soil zones, the primary causes included the loss of fine-grained soils and strength reduction due to groundwater fluctuations. In weathered rock zones, collapse was attributed to the development of discontinuities and low uniaxial compressive strength, which significantly reduced ground self-supporting capacity.

These geological conditions pose serious safety threats, especially in densely built urban areas with high surface loads. By examining real-world case studies, this paper emphasizes the inherent risks of excavating weathered ground in cities and highlights the potential for ground instability to manifest as subsidence. The findings underscore the need for heightened caution and more rigorous risk management in weathered ground zones during future underground developments in urban environments.

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