On the Split Launch Technology of Earth Pressure Balance Shield for Power Tunnels (Postprint)

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Abstract

With modern economic development and societal advancement, cities continue to develop and prosper. In the process of urban construction, shield tunneling is gradually being adopted for power tunnel projects. To address the inherent limitation of insufficient launch shaft length for power tunnels, split-launch technology enables modular disassembly of the shield machine and segmented launching, breaking through the rigid requirement of traditional integral construction that demands a shaft depth of $ $100 m, and achieving safe launching within confined spaces (shaft length $ $100 m). This achieves "space intensification, schedule controllability, and cost optimization," shortening the construction period and reducing costs compared to the traditional cut-and-cover method. Drawing upon a power tunnel project in Guangzhou, where the structural dimensions of the launch shaft are 64.6 m in length, 11.35 m in width, and 14.8 m in depth, the split-launch technology successfully resolved the challenge of limited construction space for the power tunnel project, achieving a balance between excavation efficiency and safety. Through the integration of glass fiber reinforced concrete (GFRP) pile retaining structures with the shield machine's direct cutting process, risks associated with manual intervention are reduced, while modular trolley assembly and optimization of the dynamic transportation system adapt to the narrow underground space. Engineering practice demonstrates that this technology can significantly enhance the economic efficiency and adaptability of urban underground projects, providing important technical reference for similar projects, and substantially improving the construction efficiency and economic benefits of power tunnel projects.

Full Text

Preamble

A Brief Discussion on the Split Starting Technology of Earth Pressure Balance Shield in Power Tunnels

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Abstract

With modern economic development and urban progress, shield construction has been increasingly adopted for power tunnel projects in growing cities. However, the inherent limitation of insufficient starting shaft length poses a significant challenge. The split starting technology addresses this by modularizing and disassembling the shield machine for segmented launching, thereby overcoming the traditional rigid requirement of shaft depths exceeding 100 meters for whole-machine installation. This innovation enables safe launching within confined spaces (shaft length $ $100 m), achieving space intensification, schedule controllability, and cost optimization. Compared with the conventional cut-and-cover method, this approach significantly reduces construction duration and costs.

This paper presents a case study of a power tunnel project in Guangzhou, where the starting shaft measured 64.6 m in length, 11.35 m in width, and 14.8 m in depth. Through the application of split starting technology, the project successfully resolved the challenges posed by limited construction site constraints while maintaining a balance between excavation efficiency and safety. Key technical innovations include the integration of glass fiber reinforced pile retaining structures with direct shield cutting techniques to minimize manual intervention risks, as well as optimized modularized trolley assembly and dynamic transport systems to adapt to the narrow underground workspace. Engineering practice demonstrates that this technology substantially enhances the economic viability and adaptability of urban underground engineering projects, providing a valuable technical reference for similar undertakings while greatly improving construction efficiency and economic benefits.

Keywords: Power tunnel; Split starting; Shield machine; Space constraints

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