A Preliminary Study on Slurry Balance Pipe Jacking Construction Technology in Sandy Pebble Stratum (Postprint)

Authors: Zeng Lingjian

Date: 2025-08-20T00:00:00+00:00

Abstract

In recent years, with the trend toward undergrounding and intensive development of municipal infrastructure, pipe jacking construction has been increasingly widely applied. This paper takes the Shenzhen Metro Line 16 co-constructed utility tunnel project as an example to elaborate on the construction technology and application of pipe jacking machines (including various parameters of the pipe jacking machine, construction preparation, construction process, project effects, etc.); combined with the specific engineering geological conditions of the highly water-rich sandy cobble stratum, it provides a detailed analysis of the impacts on the project from factors such as poor stratum stability, uneven distribution of sand and pebbles, and high shallow groundwater level during flood season. Through the adoption of corresponding measures including equipment adaptation, modified slurry, and construction process control, it effectively solved problems frequently occurring during the jacking process, such as deviation of the pipe jacking alignment, riverbed subsidence, disturbance to overlying pipelines, and difficulties in clearing obstacles due to clogging of slurry discharge pipelines and pumps, demonstrating that pipe jacking construction is also feasible in high water pressure sand layers and pebble layers. Pipe jacking construction technology offers advantages in municipal utility network construction, including construction safety, rapid construction speed, and minimal impact on the ground environment, enabling effective control of ground settlement, ensuring construction safety, and improving the utilization rate of urban space.

Full Text

A Preliminary Study on Slurry Balance Pipe Jacking Construction Technology in Sand and Gravel Strata

Zeng Lingjian
Guangzhou Metro Engineering Consulting Co., Ltd., Guangzhou 510000, China

Abstract: In recent years, pipe jacking construction has been increasingly employed alongside the underground and intensive development of municipal public facilities. This paper examines the shared utility tunnel project of Shenzhen Metro Line 16 as a case study to elaborate on the construction technology and application of pipe jacking machines, encompassing equipment parameters, construction preparation, construction processes, and project outcomes. Considering the specific geological conditions of high water-bearing sand and gravel strata, this study provides a detailed analysis of the impacts of poor stratum stability, uneven sand and gravel distribution, and elevated phreatic water levels during flood seasons on construction operations. By implementing targeted equipment modifications, slurry improvement, and construction process control measures, the research successfully addresses common challenges during jacking operations, including pipe axis deviation, riverbed settlement, disturbance of overlying pipelines, and difficult-to-clear blockages in slurry discharge pipes and pumps. The findings demonstrate that pipe jacking construction is feasible in high-pressure sand and gravel layers. This technology offers significant advantages in municipal pipeline network construction, including enhanced construction safety, rapid progress, minimal ground environment impact, effective ground settlement control, and improved urban space utilization.

Keywords: sand and gravel strata; circular pipe jacking; construction measures

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