

Case History of Excessive Groundwater Inflow during TBM Tunneling and Excavating Highly Permeable Ground under High Porewater Pressure

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ABSTRACT

The tunnel experienced excessive and continuous groundwater inflow followed by sudden groundwater level drawdown during shield TBM tunneling of about 53m depth when it encountered the limestone cavity network unexpectedly. The road subsidence and damage of adjacent structures were caused by 16m groundwater level drop and subsequent elastic ground settlement. The EPBM was converted to closed mode and the high elasticity urethane grout was injected in the EPBM chamber, and consequently the groundwater level was restored in 2 weeks. In order to find out the cause of unexpected excessive groundwater inflow, additional geotechnical investigation including ground borings and resistivity survey was carried out. In this study the stability of adjacent structures including subway station was evaluated through 3-dimensional numerical analysis. In addition, a ground reinforcement plan was proposed to minimize groundwater inflow and ground subsidence during excavation in a fractured zone under porewater pressure of 4bars and the suitability of the proposed measure was evaluated.

Keywords: groundwater inflow; ground subsidence; limestone cavity; EPBM; 3-D numerical analysis;

1. Introduction

Because of the possibility of rapid increase of groundwater inflow and consequent ground settlement when limestone cavities are encountered during the tunnel excavation in limestone formation, it is necessary to closely examine the geological structure of the limestone cavities and the possibility of encounters during geological

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