施工

07

大量湧水が発生した大規模な断層破砕帯を含む付加体地山を掘削

―新名神高速道路　宇治田原トンネル東工事―

西日本高速道路(株)　野本　太一

新名神高速道路宇治田原トンネルは，京都府綴喜郡宇治田原町に位置する延長約2kmの上下線3車線の大断面トンネルである．地質は丹波帯の付加体堆積物が分布し，多数のリニアメントとトンネルに沿う方向に9つの断層が存在する．その中でもっとも規模の大きい断層では地山の押し出しと大量出水が発生し天端が崩落した．復旧のため各種の検討を行い，さまざまな対策を駆使した．また，断層区間の東側区間においては，河川直下で小土かぶり(下り線11m)の施工となったが，長尺鋼管先受け工を適用して安全性を確保した．本稿では，破砕帯が多い付加体地山を掘削し，想定を上回る脆弱な断層での変状とその復旧対策を中心に報告する．

Excavation of Accretionary Wedge Containing Large Fault Fracture Zones Where Large Water Inflow Occurred

―The Shin-Meishin Expressway, the Ujitawara Tunnel East Lot―

By Taichi Nomoto, West Nippon Expressway Company Limited

The Ujitawara Tunnel on the Shin-Meishin Expressway is a 2 km-long large two-way tunnel with six lanes in Ujitawara Town, Tsuzuki County, Kyoto Prefecture. The geology along the tunnel is dominated by accretionary wedge sediments of the Tamba Belt, with numerous lineaments and nine faults. During the excavation of the largest of these faults, squeezing and large water inflow occurred and they caused the collapse of a crown. Numerous studies were conducted, and various measures were implemented to restore the site. In the eastern section of the fault zones, excavation was performed under a small earth covering (11 m on the outbound lanes) directly below the river. Here, safety was ensured by the forepiling method. In this paper, the authors report on the excavation of the accretionary wedge containing multiple fractured zones, focusing on the deformation of faults that were weaker than expected, and restoration measures.

施工

19

深さ65mの大深度・大規模ケーソン工事の沈設時対策

―名古屋市　広川ポンプ所―

日本下水道事業団　小堀　憲司

本件は，大深度（約65m）かつ大規模（長さ52m×幅29.5m）のニューマチックケーソン工法により，広川ポンプ所の地下部分の築造を行う工事である．本工事は，これまでに経験のない大深度のニューマチックケーソンでの施工であったことから，事前に周辺への影響低減対策（事前対策）を検討・実施するとともに，施工中においても当初想定し得なかった躯体が運河側に偏心するなどの事象に対して適宜追加の対策を検討・実施することで工事を進めた．本稿は，事前対策，ケーソン沈設中の周辺への影響状況，および更なる追加対策などについて報告するものである．

Measures Implemented during Construction of a Deep and Large Pneumatic Caisson at a Depth of 65 m

―Nagoya City, the Hirokawa Pumping Station―

By Kenji Kobori, Japan Sewage Works Agency

This project involves the construction of the underground portion of the Hirokawa Pumping Station using a deep (approximately 65 m) and large-scale (52 m long × 29.5 m wide) pneumatic caisson method. Because this project involved the construction of a deep pneumatic caisson that had never been experienced before, measures to reduce the impact on the surrounding area (advance measures) were considered and implemented in advance. Even during construction, additional measures were considered and implemented as necessary to deal with issues such as the eccentricity of the caisson relative to the waterway, which were not initially anticipated. In this paper, the authors report on the prior measures taken, the impact on the surrounding area during the caisson construction, and other additional measures.

研究 47

山岳トンネルにおける棒状補強材による盤ぶくれ対策に関する分析

鉄道・運輸機構　望月　一磨

山岳トンネルでは，インバート部が隆起する盤ぶくれ現象が問題となっている．この対策として，棒状補強材を打設する方法がとられることがあるが，その対策効果を明確に評価するための指標がないため，実態に応じて逐次的な対策を迫られる状況にある．本稿では棒状補強材を打設した２トンネルの計測結果から，対策前後の隆起速度の変化に注目し，その効果を整理した．また，将来的に棒状補強材による対策の目安を示すことを目的に，インバート形状に着目しつつ，トンネルセンターで分割し，左右それぞれの覆工根足においてピン接合している２つの梁とみなした構造において，棒状補強材が与える回転モーメントと対策効果を比較した．２トンネルでの計測結果しかないため，定量的な評価を行うことができる段階ではないが，今後，さらに計測データを収集することにより，棒状補強材の効果を評価できる可能性を示した．

Analysis of Measures against Heaving in Mountain Tunnels Using Bar Reinforcement

By Kazuma Mochizuki, Japan Railway, Construction, Transport and Technology Agency

In mountain tunnels, there is a problem of heaving, which causes upheaval of the invert section. One of the measures against this is to install bar reinforcements. Because there are no indicators to define the effectiveness of this measure, measures must be implemented sequentially depending on the actual situation. In this paper, the authors summarize the effects of the measures, focusing on the change in upheaval rate before and after the measures based on the measurement results of two tunnels in which bar reinforcement was installed. In addition, to provide an indicator for future measures using bar reinforcement, the authors focused on the invert shape and compared the rotational moment exerted by bar reinforcements and the effectiveness of the measures in a structure that is regarded as two beams divided at the tunnel center and supported by pin joints at the left and right lining footings. Since measurement results are available from two tunnels only, it is not yet possible to make a quantitative evaluation. Collecting further measurement data in the future will allow us to evaluate the effect of the bar reinforcement.