施工 07

大土かぶり強変質凝灰岩区間の施工と今後の計画

―北海道新幹線　後志トンネル(塩谷)―

鉄道・運輸機構　辰巳　嘉大

後志トンネルは，北海道新幹線の新函館北斗・札幌間約212kmのうち，倶知安駅から新小樽(仮称)駅間に新設される全長約18kmのトンネルであり，4工区に分けて施工を行っている．後志トンネル(塩谷)工区は，4工区のうち起点側から3番目に位置する掘削延長4,050mの工区である．斜坑交点から1,100～1,240mの区間(土かぶり450m程度)では火山活動による熱水変質を強く受けた強変質凝灰岩が出現し，土圧による大きな変位・変状が発生した．強変質凝灰岩出現区間では，各種補助工法を実施のうえ，二重支保工を採用し変位・変状の抑制を試みた．内空変位・沈下の計測結果などから変位・変状の要因を分析し，強変質凝灰岩が再度出現した際の施工計画を策定したので報告する．

Construction and Future Plans for Strongly Altered Tuff Section with a Large Soil Cover

―The Hokkaido Shinkansen, the Shiribeshi Tunnel (Shioya Lot)―

By Yoshihiro Tatsumi, Japan Railway, Construction, Transport and Technology Agency

The Shiribeshi Tunnel is an 18-km-long tunnel to be constructed between Kucchan Station and Shin-Otaru Station (tentative name) on the 212 km long Shinkansen line section between Shin-Hakodate-Hokuto Station and Sapporo Station. The construction is being carried out in 4 lots. The Shiribeshi Tunnel (Shioya) Lot is the third of the 4 construction lots from the starting point, with an excavation length of 4,050 m. In the interval from 1,100 to 1,240 m from the intersection of the inclined shaft (about 450 m of soil cover), tuff appeared, which was strongly altered hydrothermally by volcanic activity, and large displacement and deformation occurred due to earth pressure. In addition to various auxiliary construction methods implemented in the section with the strongly altered tuff, double shoring was adopted to attempt to suppress displacement and deformation. Based on the results of measurements of internal space displacement and subsidence, the factors that cause the displacement and deformation were analyzed, and a construction plan was developed in the case strongly altered tuff appears again.

施工 17

高速道路で初の矢板工法トンネルのインバート補強工事

―北陸自動車道　米山トンネル―

東日本高速道路(株)　清水　雅之

北陸自動車道米山トンネル下り線は，新潟県の柿崎IC～米山IC間に位置する矢板工法で施工された延長1,616mのトンネルであり，1983(昭和58)年に供用し約40年が経過している．1996(平成8)年に路面が最大108mm隆起し，2007(平成19)年新潟県中越沖地震により覆工表面が部分的に剝落するなどの被害が生じた．復旧後においても，路面隆起が継続していることから2022(令和4)年にインバートを設置するリニューアル工事(L=450m)を実施した．通行止めにて全幅一括で施工し，下り線は上り線側トンネルで対面通行とした．本稿は，盤ぶくれの発生状況，設計・施工検討，インバート施工時の計測，さらに対面通行区間の交通安全対策について報告する．

First Time Invert Reinforcement for a Tunnel Using Timbering Support Method on an Expressway

―The Hokuriku Expressway, the Yoneyama Tunnel―

By Masayuki Shimizu, East Nippon Expressway Company Limited

The Yoneyama Tunnel Downline on the Hokuriku Expressway is a 1,616-m-long tunnel constructed between the Kakizaki IC and Yoneyama IC in Niigata Prefecture using the timbering support method. About 40 years have passed since the tunnel was put into service in 1983. In 1996, the road surface was uplifted by up to 108 mm. Also, the Niigataken Chuetsu-oki Earthquake in 2007 caused damage such as partial peeling off of the lining surface. Since the road surface continued to rise after restoration, renewal work to install an invert (L = 450 m) was carried out in 2022. The entire width of the tunnel was constructed in one piece during the road closure, and the downstream line was set up on the upstream side of the tunnel to enable 2-way traffic. In this paper, the authors report on the occurrence of the swelling, design and construction studies, measurements during invert construction, and traffic safety measures in the 2-way traffic section.

施工 47

中央構造線に隣接した地すべり地を坑内外からの各種対策工により貫通
―松山自動車道　明神山トンネルⅡ期線―

西日本高速道路(株)　石井　隆明

松山自動車道明神山トンネルは愛媛県伊予市に位置し，伊予IC～内子五十崎IC間の４車線化事業における延長2,545mのⅡ期線トンネルである．当該トンネルは，中央構造線の影響を受けており，とくに貫通点側坑口付近では地すべり不安定地山と家屋などが存在する厳しい条件下であった．本稿は，供用線の施工記録をもとに，種々の地すべり対策工や上半先進工法に仮インバートなど，補助工法を駆使して施工した結果，供用トンネルと地表部への影響を軽減できたことについて報告する．

Penetrating the Landslide Area Adjacent to the Median Tectonic Line with Various Measures from inside and outside the Tunnel
―The Matsuyama Expressway, the Myojinsan Phase II Tunnel―

By Takaaki Ishii, West Nippon Expressway Company Limited

The Myojinsan Tunnel on the Matsuyama Expressway is located in Iyo City, Ehime Prefecture. It is a 2,545-m-long Phase II tunnel and a part of the 4-lane construction project between the Iyo IC and Uchiko Igasaki IC. The tunnel is affected by the Median Tectonic Line. There are severe conditions, such as houses and landslides, especially in the vicinity of the tunnel portal on the penetration point side. In this paper the authors report on various landslide measure works, temporal inverts, and other advanced construction methods for the top section based on the construction record of the in-service line. In this paper, authors report on the tunnel with auxiliary methods reduced the impact on the in-service tunnel and the ground surface.

施工 57

２次元FEMを用いてHEP＆JES工法が地表面に及ぼす影響を検討
―公共つくばエクスプレス沿線整備工事―

鉄建建設(株)　矢島　　岳

非開削アンダーパス工法のひとつであるHEP＆JES工法は，施工時の開放面積が小さく地表面に与える影響が小さい工法である．近年，地下構造物の大型化に伴い，掘削面積の増加や土かぶり厚の縮小が考えられ，路面沈下に対する事前検討が必要になる場合が想定される．今回，HEP＆JES工法が採用された国道16号下を横断するアンダーパス工事において，地表面変位を連続的に計測することができたため，実測値と２次元FEMの解析結果を比較した．本稿ではHEP＆JES工法における地盤影響解析手法や地表面に与える影響について報告する．

Studying the Effect of HEP & JES Construction Method on the Ground Surface Using 2D FEM
―Public Works near the Tsukuba Express Line―

By Gaku Yajima, Tekken Corporation

The HEP & JES method, one of the trenchless underpass methods, has a small open area during construction and has little impact on the ground surface. In recent years, as underground structures have become larger, the excavation area has increased and the soil cover thickness has decreased, and it is assumed that prior consideration of road surface settlement may be necessary. In the construction of the underpass crossing under National Route No. 16, where the HEP & JES method was adopted, we were able to continuously measure the ground surface displacement and compared the actual measured values with the results of 2D FEM analysis. In this paper, authors report on the ground impact analysis method and its effect on the ground surface in the HEP & JES construction method.

施工

67

大規模貯留施設の大深度・長距離シールドによる設計施工

―名古屋市上下水道局　名古屋中央雨水調整池―

名古屋市　田中　考二

名古屋市では，2000(平成12)年９月に東海地方を襲った東海豪雨や2008(平成20)年８月末に発生した豪雨で著しい浸水被害を受けた地域や都市機能が集積している地域を対象に「緊急雨水整備事業」を実施し，シールド工法などによる雨水貯留管の築造などの浸水対策事業を進めている．今回，名古屋駅周辺を含む中川運河上流地域における能力増強のための雨水調整池整備として，内径5,750mm，延長約5,000m，深さ約50mのシールドを施工している．設計施工にあたり大深度，高水圧下における，立坑からのシールド発進，到達時およびシールドどうしの地中接続時の止水対策，加えて長距離掘進に伴うビット交換の施工方法などについて検討を重ねた．本稿では，それらの設計施工上の各種工夫点などについて報告する．

Design and Construction of a Large Scale Reservoir Facility Using a Large Depth, Long Distance Shield TBM

―Nagoya City Waterworks and Sewerage Bureau, Nagoya Central Rainwater Regulating Reservoirs―

By Koji Tanaka, Nagoya City

The City of Nagoya has implemented the “Emergency Rainwater Improvement Project” targeting areas that were severely inundated by the torrential rains that hit the Tokai region in September 2000 and again at the end of August 2008, as well as areas with a high concentration of urban functions. The construction of rainwater collecting pipes using the shield method and other inundation control projects are underway. This time, a shield TBM with an inner diameter of 5,750 mm, a length of approximately 5,000 m, and a depth of approximately 50 m is being constructed to increase the capacity of rainwater regulating reservoirs in the upstream area of the Nakagawa Canal, including the Nagoya Station area. During design and construction, we studied water sealing measures used when starting and reaching the shield from the shaft, and when connecting the shields underground at a great depth and under high water pressure, as well as the method of bit replacement for long-distance tunneling. In this paper, the authors report on the design and construction of these measures.