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新幹線保守設備の設置に向けた分岐を伴う大断面トンネルの施工
―北海道新幹線　渡島トンネル上二股工区―

鉄道・運輸機構　大塚　優作

渡島トンネルは北海道新幹線において新函館北斗駅から新八雲(仮称)駅間に位置する全長約32.7kmの山岳トンネルであり，7つの工区に分けて施工している．このうち，渡島トンネル(上二股)工区は，新函館北斗起点方坑口より6つ目の工区で約4.5kmを施工するものである．北海道新幹線では約30kmごとに保守用車両を留置する施設を整備する必要がある．そこで，新函館北斗駅と新八雲(仮称)駅のおよそ中間地点に位置する当工区にトンネルで分岐し保守用車両を留置する横取基地を設置することとなった．本稿では，渡島トンネル(上二股)工区における横取基地の設置に伴う240m^{2}の大断面トンネルおよび分岐トンネルの設計・施工実績について報告する．

Construction of a Large Cross-Section Tunnel with a Branch for Installation of Shinkansen Maintenance Facilities
―The Hokkaido Shinkansen, the Oshima Tunnel, the Kamifutamata Lot―

By Yusaku Otsuka, Japan Railway, Construction, Transport and Technology Agency

The Oshima Tunnel is a 32.7 km-long mountain tunnel between the Shin-Hakodate-Hokuto station and the Shin-Yakumo station (tentative name) on the Hokkaido Shinkansen. The construction is divided into seven sections. The Kamifutamata section is the sixth construction section from the Shin-Hakodate-Hokuto starting point, covering approximately 4.5 km. The Hokkaido Shinkansen requires the construction of facilities for storing maintenance vehicles approximately every 30 km. Therefore, it was decided to establish a side depot for storing maintenance vehicles, branching off via a tunnel in this construction section, which is located approximately halfway between the Shin-Hakodate-Hokuto station and the Shin-Yakumo station (tentative name). In this paper, the authors report on the design and the construction of a 240 m^2 large cross-section tunnel and a branch tunnel intended for the construction of the side depot in this construction section.

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九州初となる道路シールドトンネルの掘進開始までの課題と対応
―鹿児島東西道路トンネル―

国土交通省　佐藤　博信

鹿児島東西幹線道路は，九州縦貫自動車道および南九州自動車道などの結節点である鹿児島ICと鹿児島市中心市街地および鹿児島港を結ぶ高規格道路である．鹿児島東西幹線道路の一部である，鹿児島東西道路は，鹿児島IC～甲南IC(仮称)までの延長3.4kmの区間であり，これまでに鹿児島IC～田上IC間延長0.4kmが4車線，田上IC～建部IC間延長1.8kmが2車線で開通している．田上IC～甲南IC(仮称)間延長2.3kmについて，九州の道路トンネルでは初めてとなるシールド工法を採用し，2023(令和5)年11月から工事着手した．本稿では，シールド工事着手までに実施した，小土かぶり部の地盤調査の結果や，支障物への対応状況，到達側坑口の斜面安定対策などについて紹介する．

Challenges and Responses before the Start of Excavation of Kyushu's First Road Shield Tunnel
―The Kagoshima Tozai Road Tunnel―

By Hironobu Sato, Ministry of Land, Infrastructure, Transport and Tourism

The Kagoshima Tozai Expressway is a high-standard road connecting the Kagoshima IC, the junction of the Cross Kyushu Expressway and the Minami-Kyushu Expressway, with the center of Kagoshima City and Kagoshima Port. The Kagoshima Tozai Road, part of the Kagoshima Tozai Expressway, stretches 3.4 km from the Kagoshima IC to the Konan IC (tentative name). To date, the 0.4 km-long four-lane section between the Kagoshima IC and the Tagami IC and the 1.8 km-long two-lane section between the Tagami IC and the Kenbu IC have been opened. The construction of the 2.3 km-long section between the Tagami IC and the Konan IC (tentative name) began in November 2023. This section is the first road tunnel in Kyushu constructed using the shield tunneling method. In this paper, the author introduces the results of the ground surveys of the small earth cover that were carried out before the shield tunneling began, measures against obstacles, and slope stabilization measures implemented at the entrance of the shield tunnel on the arrival side.

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礫層中に軟弱層を含む地盤や連続する急曲線部でのシールド施工

―清瀬市公共下水道　柳瀬川右岸５号雨水幹線―

東洋・今村建設共同企業体　髙柳　　悟

清瀬市では，近年の集中豪雨や大型台風による浸水被害を軽減すべく，市内でもとくに被害箇所が集中する柳瀬川右岸地区において，2013(平成25)年度より，柳瀬川右岸５号雨水幹線の築造に着手し，整備を進めてきた．本工事は，この最終段階にあたるもので，R=10mの連続急曲線施工ならびに軟弱層を含む地盤における急曲線施工，発進立坑から到達立坑まで約1,000mの連続施工が可能であることが必須条件であったため，泥土圧式ミニシールド工法を選定し，施工した．本稿では，施工上の課題に対し，礫層と粘性土層に適応したマシン製作，最適なジャッキ推力の選定など実施した対策の内容とその実績について報告する．

Shield Tunneling through Continuous Steep Curves in the Ground Containing Weak Layers in Gravel

―The Kiyose City Sewerage, the Right Bank of the Yanase River No. 5 Rainwater Sewer Main―

By Satoru Takayanagi, Toyo Imamura Joint Venture

The construction of the No. 5 rainwater sewer main on the right bank of the Yanase River began in FY2013 to mitigate inundation damage caused by recent heavy rains and large typhoons in Kiyose City. The sewer is being constructed on the right bank of the Yanase River, where damage was particularly concentrated in the city. This construction was the final stage of the project and the muddy soil pressure balanced mini-shield method was selected for the construction because it was necessary to construct a continuous steep curve of R = 10 m and steep curves in the ground containing weak layers and to perform a continuous construction of approximately 1,000 m from the starting shaft to the arrival shaft. In this paper, the authors report on the measures taken to address the construction challenges, including the development of a machine suitable for gravel and clay, the selection of the optimal jacking force, as well as the results of these measures.

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北スマトラの礫質砂岩下で地下発電所と長距離導水トンネルを建設

―インドネシア　アサハン第３水力発電所―

清水建設(株)　高岡　秀明

アサハン第３水力発電所は世界最大のカルデラ湖であるトバ湖から流れ出るアサハン川の水を利用して，インドネシア共和国北スマトラ州に建設中の流れ込み式の水力発電所(174MW)である．本トンネルルートは，主にアサハン川左岸の土かぶり70～400mの礫質砂岩にある．2019年３月28日の着工以降，アクセス道路の伐採より着手し，明かり工区ではアサハン川を切り回して取水堰，開水路，取水庭を構築，トンネル工区では地下発電所・斜坑・４箇所の立坑を含む総延長10.9kmに及ぶトンネル掘削および覆工コンクリートの施工を進め，2024年３月に５年の工期で竣工した．本稿では地下発電所を含むトンネル工事について，コロナ禍での取組みやICT技術の活用と合わせて報告する．

Construction of Underground Power Plant and Long-Distance Headrace Tunnel in Gravelly Sandstone in North Sumatra

―Republic of Indonesia, the Asahan No. 3 Hydroelectric Power Plant―

By Hideaki Takaoka, SHIMIZU CORPORATION

The Asahan No. 3 Hydroelectric Power Plant is a run-of-river type hydropower plant (174 MW) currently under construction in North Sumatra, Republic of Indonesia. The power plant uses water from the Asahan River, which flows from Lake Toba, the world's largest caldera lake. This tunnel route is located mainly on the left bank of the Asahan River with a soil cover of 70 to 400 m of gravelly sandstone. After the start of the construction on March 28, 2019, the works began with clearing trees to prepare the access road. In the outside construction area, the Asahan River was diverted to construct an intake weir, an open channel, and a water buffer. The works in the tunnel section included excavation and construction of concrete lining for a total length of 10.9 km, including an underground power plant, incline, and four shafts. The work was completed in March 2024 after a five-year construction period. In this paper, the authors report on the tunneling, including the underground power plant, along with efforts made during the COVID-19 pandemic and the use of ICT technology.

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東京メトロ有楽町線・南北線の延伸計画

東京地下鉄(株)　白子　慎介

東京メトロは，前身の帝都高速度交通営団が銀座線14.3kmをもって発足して以来，1951年４月の丸ノ内線建設着手を皮切りに，2008年６月の副都心線開業に至るまで，首都東京を中心として９路線，総計195.0kmの地下鉄ネットワークの整備拡充と運営に努めてきた．このたび，有楽町線延伸および南北線延伸について，交通政策審議会答申第371号にもとづき，2022年１月に鉄道事業許可を申請し，３月に国土交通大臣より許可を受けた．有楽町線延伸は，豊洲駅から東西線東陽町駅を経て半蔵門線住吉駅に至る約5.2kmの路線であり，駅は既設の豊洲駅および住吉駅を除き，新たに東陽町駅と鉄道不便地域の解消を目的とした枝川駅，千石駅の計３駅(いずれも仮称)を設置する計画である．南北線延伸は，白金高輪駅から品川駅(仮称)に至る約2.8 kmの路線であり，東京メトロとして初めて品川駅に進出するルートである．本稿では，有楽町線延伸部および南北線延伸部の計画概要，地形・地質概要などについて紹介したのち，本延伸工事の施工計画における特徴について述べる．

Extension Plans of Tokyo Metro the Yurakucho Line and the Namboku Line

By Sinsuke Shirako, Tokyo Metro Co., Ltd.

Since its predecessor, the Teito Rapid Transit Authority was established with the 14.3 km Ginza Line, Tokyo Metro has worked to develop, expand, and operate a subway network of nine lines with a total length of 195 km, mainly in the Tokyo metropolitan area, beginning with the Marunouchi Line construction in April 1951 and continuing until the opening of the Fukutoshin Line in June 2008. Based on the Reply No. 371 of the Council for Transport Policy regarding the extension of the Yurakucho Line and the Namboku Line, an application for railway business permission was filed in January 2022, and approval was received from the Minister of Land, Infrastructure, Transport and Tourism in March. The extension of the Yurakucho Line is a 5.2 km line that will run from the Toyosu Station to the Sumiyoshi Station on the Hanzomon Line via the Toyocho Station on the Tozai Line. In addition to the existing the Toyosu Station and the Sumiyoshi Station, the plan is to establish three new stations, the Toyocho Station, the Edagawa Station, and the Sengoku Station (all names are tentative), to alleviate the inconvenience of train access in these areas. The extension of the Nanboku Line is a 2.8 km line that will run from the Shirokane-Takanawa Station to the Shinagawa Station (tentative name). It will be the first route for Tokyo Metro to extend to the Shinagawa Station. In this paper, the authors present an overview of the extensions of the Yurakucho Line and the Namboku Line, as well as the topography and geology of the area, and describe the features of the construction plan for this extension project.