

北陸新幹線柿原トンネルは、福井県あわら市に位置する延長2,530mの山岳トンネルである。このトンネルの中間部の約850m区間は土かぶり1D未満の小土かぶり区間(農地)で、 N 値10~20程度の洪積層粘性土および砂質土が主体であることより、トンネルを構築するためには、安定化対策が必要であった。そこで、小土かぶりの地形および地質的特徴のほか、工程・品質・経済性を検討し、トンネル掘削前に安定化対策として事前にできるだけ広範囲に浅層混合改良などにより地山を改良して施工することが有効であると判断した。本稿では、この設計および施工について報告する。

Improving the Ground before Excavation of a Shallow Tunnel

—The Hokuriku Shinkansen, the Kakibara Tunnel—

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The Kakibara Tunnel on the Hokuriku Shinkansen is a 2,530 m-long mountain tunnel in Awara City, Fukui Prefecture. The 850 m-long section in the middle of the tunnel is a shallow section (farmland) with an overburden of less than 1D. The geology of the section is mainly composed of Pleistocene clay and sandy soil with an N value of about 10 to 20, so stabilization measures are necessary to construct the tunnel. After considering the topography and geological characteristics of the small overburden, as well as the process, quality, and economics, it was determined that it would be effective to improve the ground in advance as much as possible by shallow soil mixing and other methods as a stabilization measure before tunnel excavation. In this paper, the authors report on the design and construction of the measures.

国道57号滝室坂道路は、大分県と熊本県を結ぶ高規格道路中九州横断道路の一部を形成し、滝室坂という峠道をトンネルで貫くことで災害発生時の代替路確保、走行性の向上などを目的とした事業である。国道57号滝室坂道路の主要構造物である滝室坂トンネル(仮称)は年代の異なる阿蘇火砕流堆積物を複数貫くため、地質が複雑であるとともに地質境界で大量湧水が予想されていた。これらの地質は非溶結～強溶結と変化に富む凝灰岩を主体とし、先阿蘇火山岩類では地山強度比1以下の脆弱地山であることが予測され、地山の押し出しによるトンネルの大変形が懸念されていた。また、阿蘇-1・2間隙堆積物ではトンネル掘削時に12m³/分もの大量湧水が予想されていた。本稿は、滝室坂トンネルを西側から施工した坂梨工区における脆弱地山区間や大量湧水区間の施工結果と、中間ポンプ室で採用したプレキャスト覆工について報告するものである。

Tunnel Construction in Dealing with Complex Ground and Large Water Inflow into the Tunnel on the Outer Rim of Mt. Aso

—The National Route 57, the Takimurozaka Tunnel, the Sakanashi Lot—

By Hisataka Nagamatsu, Ministry of Land, Infrastructure, Transport and Tourism

The Takimurozaka road on National Route 57 forms part of Naka-Kyushu Odan Road, a high-standard road connecting Oita Prefecture and Kumamoto Prefecture. The purpose of this project was to secure an alternative route in the event of a disaster and to improve driving performance by excavating a tunnel through the mountain pass called Takimurozaka. The Takimurozaka Tunnel (tentative name), the main structure of the Takimurozaka Road on National Route 57, passes through multiple Aso pyroclastic flow deposits of different ages on Mt. Aso, making the geology complex. Massive water inflows into the tunnel at the geological boundaries are expected. The area's geology is mainly composed of tuff, which varies from no welding to dense welding, and was predicted to be weak ground with a strength ratio of less than 1 for the pre-Aso volcanic rocks. There were concerns that the tunnel would be severely deformed due to the ground squeezing. In addition, a large inflow of water as much as 12 m³/min was expected during tunnel excavation in the deposit between Aso-1 and Aso-2. In this paper, the authors report on the results of the construction of the Sakanashi Lot of the Takimurozaka Tunnel from the west side, including the weak ground section and the large water inflow section, and the precast lining used for the intermediate pump room.

施工

狭小環境における立坑築造と主要都道直下でのシールド施工

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—東京都水道局 王子給水所新設に伴う配水管整備—

東京都 富井 康雄

東京都水道局では、平常時よりも震災時などにおける給水の安定性をさらに向上させるため北区王子に新たな給水所を築造中である。これに伴い給水所を起点とした延長約5 kmに及ぶ地区配水のための新たな配水管の布設が必要となった。現在、路線を2つの工区に分割して配水管の新設工事を進めており、本工事は、外径2,210mmのシールドで延長2.8kmのトンネルを築造後、トンネル内に内径800mmの配水管を布設するものである。到達立坑は住宅が密集する市街地かつ狭小な施工ヤードのなかで深さ約26mの立坑を築造する必要があった。また、シールド路線は、交通量の多い主要都道である明治通り直下であったため、慎重な施工が求められた。本稿では立坑築造における施工や設備配置などにおける工夫とともにシールド掘進時の施工管理について報告する。

Shaft Construction in a Narrow Environment and Shield Construction Directly under a Major Metropolitan Road**—Bureau of Waterworks, Tokyo Metropolitan Government, Water Pipeline Project for New Oji Water Supply Station—****By Yasuo Tomii, Tokyo Metropolitan Government**

The Bureau of Waterworks of the Tokyo Metropolitan Government is constructing a new water supply station in Oji, Kita City, to further improve the stability of water supply not only under normal circumstances but also in the event of an earthquake and others. This necessitated the construction of a new water distribution pipeline extending approximately 5 km from the water supply station and used to distribute water to the district. Currently, the pipeline project is being divided into two lots for the construction of new water distribution pipes. This project involves the construction of a 2.8 km-long tunnel using a shield TBM with an outside diameter of 2,210 mm, and the installation of water distribution pipes with an inner diameter of 800 mm inside the tunnel. The arrival shaft had to be constructed in a narrow construction yard in an urban area with a high concentration of residential buildings and was approximately 26 m deep. The tunneling route was directly under Meiji-dori Avenue, a major metropolitan road with heavy traffic, so careful construction was required. In this paper, the authors report on the construction management during shield tunneling, as well as the innovations in shaft construction and equipment arrangement.