

北海道新幹線国縫トンネルは北海道長万部町内に位置する延長1,340mの山岳トンネルであり、重要構造物である道央自動車道(以下、「高速道路」として記載)と最小約7.4mの土かぶりで交差する。高速道路交差部の地質は、礫岩や砂、粘土を主体とする固結度の低い層が分布しており、掘削中の切羽の安定が確保できず直上の高速道路構造物に影響を与える懸念があった。そこで、同トンネルの高速道路交差部と類似した土かぶり、地質条件の箇所にて交差部の掘削を想定したトリアル施工を行い、得られた計測値や施工結果から実際の交差部の施工計画を立案し、施工に臨んだ。その結果、高速道路に影響を与えることなく高速道路交差部の施工を完了した。

### Tunneling of Shallow Section under the Expressway Using Trial Construction Results —The Hokkaido Shinkansen, the Kunnui Tunnel—

By Atsushi Ito, Japan Railway, Construction, Transport and Technology Agency

The Hokkaido Shinkansen, the Kunnui Tunnel is a 1,340-m-long mountain tunnel located in Oshamanbe town, Hokkaido. The tunnel crosses under the Hokkaido Expressway, an important structure, with a minimum earth covering of approximately 7.4 m. The geology condition under the expressway is composed of poorly consolidated ground consisting mainly of conglomerate, sand, and clay. There were concerns that the stability of the face during excavation could not be ensured, which would affect the expressway structure directly above the tunnel. Therefore, a trial excavation was conducted at a location with earth covering and geological conditions similar to those of the section under the expressway, and a construction plan for the actual section was developed based on the obtained measurements and construction results. As a result, the excavation under the expressway was completed without affecting the expressway.

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、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。計画延長6.3kmのうち、滝室坂トンネル(仮称)が延長約4.8kmを占め、大分県側の波野工区、熊本県側の坂梨工区に分割して施工をしている。本工事は、大分県側から熊本県側へ掘削する、波野工区(滝室坂トンネル東新設工事)である。本稿は、阿蘇特有の溶結凝灰岩中の非溶結凝灰岩および未固結火山灰などで構成される脆弱層において発生した変状に対して、脚部沈下対策、水抜きボーリングによる水圧低減対策、また、将来の覆工への荷重作用を想定した覆工補強などの取り組みについて報告するものである。

## Measures against Deformation and Reinforcement of Lining in Poor Rock Mass Peculiar to the Outer Rim of Aso Mountains

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

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

The Takimurozaka road on the National Route 57 is included in the central Kyushu transversal motorway that is a high-standard motorway connecting Oita and Kumamoto prefectures. The road contributes to ensuring an alternative route during a disaster and to improving the vehicle traveling performance. In the Takimurozaka road with 6.3 km length in design, the Takimurozaka tunnel (tentative name) dominantly covers about 4.8 km. The tunnel is under construction and divided into two construction lots: the Namino lot in the Oita side and the Sakanashi lot in the Kumamoto side. This report describes about the Namino lot named as the Takimurozaka tunnel East section construction project where the tunnel is excavated from Oita to Kumamoto.

In this paper, the authors report the measures against large tunnel deformation and the improvement of secondary lining in the Takimurozaka tunnel East section construction project. They were required for overcoming the poor rock mass consisting of non-welded parts in welded tuff layers, the unconsolidated volcanic ash layers and so on, which is particularly distributed in the Aso region.

船来山トンネルは、東海環状自動車道の西部に位置する延長461mの山岳トンネルである。当現場では働き方改革という近年の情勢から、覆工コンクリートの生産性と品質の向上という課題に取り組んだ。ICTや各種要素技術を組み合わせて、9m長の覆工セントルを用い覆工毎日打設システムを構築し、覆工コンクリートの積算温度にもとづく新たな強度管理手法を検討した。その結果、打設サイクルの短縮化と現場作業の省力化が図れ、高い品質での施工が実現された。本稿では、これらの取り組みと得られた施工実績の詳細について紹介する。

## Daily Cast for Lining Concrete to Improve Productivity and Quality

—The Tokai-Kanjo Expressway, the Funakiyama Tunnel—

By Takanori Kondo, Central Nippon Expressway Company Limited

The Funakiyama Tunnel is a 461-m-long mountain tunnel located in the western part of the Tokai Kanjo Expressway. In response to the recent trend of work style reforms, the issue of improving the productivity and quality of the concrete lining was addressed at this site. A daily casting system for lining concrete using a 9-m-long tunnel lining form was constructed by combining ICT and various elemental techniques, and a new strength control method based on the accumulated temperature of lining concrete was investigated. As a result, the casting cycle was shortened, labor saving of on-site work was achieved, and high-quality lining was produced. In this paper, the authors present details of the various efforts and the construction results.

施工

## 日本初の超大断面トンネル型減勢工の建設

—天ヶ瀬ダム再開発事業 減勢池部—

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天ヶ瀬ダム再開発事業は、天ヶ瀬ダムの放流能力を毎秒600m<sup>3</sup>に増強するため、景観と環境に配慮して同ダムの左岸側地山内に全長617mのトンネル式放流設備を建設する事業である。このうち延長170mの減勢池部は、主ゲートからの高圧・多量の放流水を宇治川へ流す前に減勢させる国内初のトンネル型施設として、仕上がり内空が約500m<sup>2</sup>という日本最大級の水路トンネルを築造する。超大断面、小土かぶり、破碎帯、狭隘な坑口ヤードなど過酷な条件下で、高耐久の減勢工を完工するという非常に難易度の高いトンネル工事であった。本稿では、日本初の超大断面トンネル型減勢工の施工および情報化施工を報告する。

**Construction of Japan's First Super-Large Cross-Section Tunnel for Stilling Basin  
—The Amagase Dam Redevelopment Project, Stilling Basin—****By Shunsuke Inui, Ministry of Land, Infrastructure, Transport and Tourism**

The Amagase dam redevelopment project includes the construction of a spillway tunnel with a total length of 617 m on the left bank of the reservoir to increase the discharge capacity of the Amagase dam by 600 m<sup>3</sup> per second, taking into consideration the landscape and environment. The 170-m-long stilling basin is Japan's first tunnel type facility used to still large volume and high-pressure discharges from the main gate before they flow into the Uji River. This facility is one of the largest waterway tunnels in Japan, with a finished interior area of approximately 500 m<sup>2</sup>. This was an extremely challenging tunnel construction project that required the construction of a highly durable stilling basin under harsh conditions, including a very large cross-section, small earth covering, fracture zones, and a narrow tunnel portal yard. In this paper, the authors report on the construction of Japan's first super-large cross-section tunnel for stilling basin and the use of computerized construction techniques in this project.