

中国自動車道北房IC～新見IC間に位置する高尾トンネル(上り線)では、供用後に盤ぶくれによる路面隆起が発生し、従来の舗装切削(擦り付け)や路盤下ロックボルト補強では対応に限界があった。恒久対策として、覆工の背面空洞注入および側壁ロックボルトによる沈下対策や計測管理のもと、全幅一括施工・連続片押し方式によりインバートを新設した。各計測値は管理基準内で推移・収束し、施工性と工程確保を両立できた。本稿では、施工方式の選定から補強後の維持管理の考え方を報告する。

Measures against Ground Heaving through Construction of a New Invert in an In-Service Tunnel Built with the Timbering Support Method

—The Chugoku Expressway, the Takao Tunnel—

By Kenichi Kakinoki, West Nippon Expressway Company Limited

In the Takao Tunnel (upbound), located between the Hokubo IC and the Niimi IC on the Chugoku Expressway, some upward deformation on the pavement surface caused by ground heaving occurred after the tunnel was opened to traffic. Conventional measures, such as pavement milling (surface grinding) and rock-bolt reinforcement beneath the roadbed, proved insufficient. As a permanent measure, a new invert was built by casting the full width at once, with works progressing in one direction under measurement management, accompanied by measures against settlement such as backfill grouting behind the lining and installation of sidewall rock bolts. Measurement results remained within the prescribed control criteria and converged satisfactorily, simplifying the construction and allowing it to meet the schedule. This paper reports on the process from the selection of the construction method to post-reinforcement maintenance management concepts.

本工事は、日田市と中津市を結ぶ高規格道路(日田山国道路 $L=8.8\text{km}$)のうち、延長 $1,558\text{m}$ の避難坑をNATMにより施工するものである。当初より層境では湧水の発生が懸念されていたため、切羽前方探査を実施しながら慎重に施工を行ったが、突発湧水と切羽崩落が発生した。崩落時の状況から、補助工法や水抜きボーリングの仕様を見直し、当該区間を安全に突破することができた。しかし、切羽崩落の影響によりトンネル背面に 10m^3 の空洞が形成された。長期的なトンネルの安定性を確保するため、空洞部の充填を行う必要があるが、空洞部には常に多量の湧水が流入していた。そこで、止水系ウレタン注入材によって空洞部に流入している湧水量の低減を行い、空洞部の充填を実施した。本稿では、上記の切羽安定対策と大量湧水下での空洞充填の施工結果について報告する。

Battling Groundwater Inflow during Preceding Works for an Evacuation Tunnel in Oku-Yabakei

—The Hita-Yamakuni Road, the No. 1 Tunnel, the Evacuation Tunnel Lot 2—

By Takamichi Yoshioka, Oita Prefecture

This project involves the construction of a $1,558\text{-m}$ -long evacuation tunnel using the NATM as part of a high-standard road (Hita Yamakuni Road, $L=8.8\text{ km}$) connecting Hita City and Nakatsu City. From the beginning, groundwater inflow was anticipated at the boundaries of geological layers. Therefore, construction proceeded cautiously while probing ahead of the tunnel face. Nevertheless, a sudden water inflow and face collapse occurred. Based on the conditions observed at the time of collapse, the specifications of auxiliary methods and dewater borings were reviewed, allowing the affected section to be passed safely. However, as a result of the face collapse, a void of approximately 10 m^3 formed behind the tunnel. To ensure the long-term stability of the tunnel, it was necessary to fill this void, but a large volume of groundwater was continuously flowing into it. The groundwater inflow into the void was first reduced using the water-stopping polyurethane grout, after which the void was filled. This paper reports the results of the face stabilization measures and the void filling works conducted under conditions of heavy groundwater inflow.

日本原子力研究開発機構は、幌延深地層研究センターにおいて、高レベル放射性廃棄物の地層処分に關する研究開発を行っている。幌延深地層研究センターは北海道幌延町に位置し、2023(令和5)年度からは、地下研究施設整備の第Ⅲ期事業として、深度500mに向けた3本の立坑(換気立坑(内径4.5m)、東・西立坑(内径6.5m))掘削および深度500mの水平坑道(掘削断面積 14.0m^2)掘削を実施しており、2025(令和7)年度末の工事完了に向けて施工を進めている。本事業のうち、立坑の施工は地下研究施設整備の早期完成に大きく影響し、施工の合理化が重要な課題のひとつであった。これに対し、数値解析による覆工コンクリートの仕様検討や発生応力の予測、覆工応力計測による情報化施工の取り組みなどを実施したので、その内容を報告する。

Specification Studies and Information-Oriented Construction of Lining Concrete for Shaft Excavation to a Depth of 500 m

—Horonobe Underground Research Laboratory, Underground Research Facilities Project (3rd Period)—

By Tomoyuki Nishitani, Taisei, Obayashi, Sumitomo Mitsui Joint Venture

The Japan Atomic Energy Agency has conducted research and development towards geological disposal of high-level radioactive waste at the Horonobe Underground Research Center. The Horonobe Underground Research Center is in Horonobe Town, Hokkaido. Since FY 2023, as 3rd Period of the underground research facility development project, excavation has been underway for three shafts toward a depth of 500 m, namely a ventilation shaft (inner diameter of 4.5 m) and the east and west shafts (inner diameter 6.5 m), as well as a horizontal drift at a depth of 500 m (excavation cross-sectional area of 14.0 m^2). Construction is progressing toward completion by the end of FY 2025. In this project, construction has a significant impact on the early completion of the underground research facility, making rationalization of the construction one of the key challenges. To address this issue, specification studies of lining concrete using numerical analysis, prediction of induced stresses, and information-oriented construction using lining stress measurements were conducted. This paper reports on these efforts.

報告

「設立50周年記念保守管理特別講演会」報告

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—トンネルの維持管理の現状と最近の話題—

(一社)日本トンネル技術協会

本会設立50周年記念事業の一環として、2025年10月15日に「設立50周年記念保守管理特別講演会—トンネルの維持管理の現状と最近の話題—」を開催した。本講演会は、JTA技術委員会保守管理小委員会のもとで企画し、会場のほかりモートでの参加も可能としたハイブリッド方式で行われ、会場95名、リモート156名の合計251名が参加した。講演会では、朝倉俊弘・京都大学名誉教授による基調講演のほか、各団体の「トンネル維持管理の現況と最近の話題」の紹介、講師によるパネルディスカッションが行われた。本稿では、その概要を報告する。

Report on the 50th Anniversary Commemorative Special Lecture on Maintenance Management**—Current Status and Recent Topics in Tunnel Maintenance Management—****By Japan Tunnelling Association**

As part of the 50th anniversary commemorative projects of this association, the “50th Anniversary Commemorative Special Lecture on Maintenance Management —Current Status and Recent Topics in Tunnel Maintenance Management—” was held on October 15, 2025. The lecture was planned under the Maintenance Management Subcommittee of the JTA Technical Committee and was conducted in a hybrid format that allowed participation both onsite and remotely. A total of 251 participants attended, including 95 on-site attendees and 156 remote participants. The program included a keynote lecture by Professor Emeritus Toshihiro Asakura of Kyoto University, presentations by various organizations on the current status and recent topics in tunnel maintenance management, and a panel discussion by the lecturers. This paper presents an overview of the event.