トンネルと地下　VOL.49　No.3　掲載概要

掲載頁 7

既設トンネルから分岐した迂回トンネルにより地すべりを回避
―国道445号　瀬目トンネル―

熊本県　山本　清孝

1995(平成７)年に完成した国道445号瀬目トンネル(延長695m)は，供用開始後の2000(平成12)年に終点側坑口から約280m付近の覆工コンクリート側壁部に剝離が確認され，道路管理者である熊本県と国土交通省は，各種調査の結果，剝離などの変状の原因を地すべりによるものと位置づけ，監視体制を構築するとともに応急対策を講じつつ供用を続けてきた．しかしその間，変状の範囲は覆工区画15スパン(L＝149m)までに拡がり変状の程度も顕著となったことから，一般交通の安全を確保するために迂回トンネルが計画された．

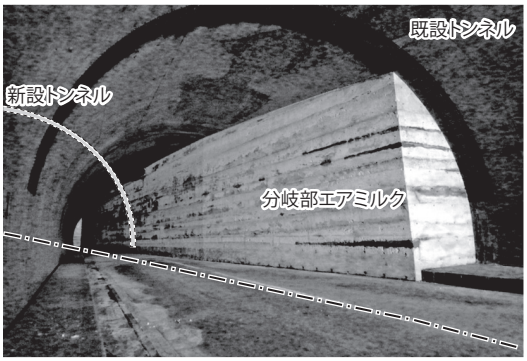
本稿は既存の起・終点坑口を存置し，かつ地すべり帯を避けるため，急曲線線形により新たなトンネルを構築する災害復旧工事の施工結果について報告するものである．

A Bypass Tunnel Diverged from an Existing Tunnel to Avoid Landslides― the National Route 445, the Seme Tunnel―

By Kiyotaka Yamamoto, Kumamoto prefecture

In 2000, after the opening of the Seme Tunnel (695m) in 1995, which carries the National Route 445, delaminations were confirmed on lining concrete of the tunnel walls approximately 280m from the portal of the exit side. As a result of various surveys, Kumamoto Prefecture and the Ministry of Land, Infrastructure and Transport, the road administrators, assessed that the deformations such as delaminations were caused by landslides, and have continued the tunnel service while establishing a surveillance system and taking emergency measures. However, in the meanwhile, the range of the deformation expanded to up to 15 sections (L=149m) of the tunnel lining and the degree of deformation started to become more noticeable, resulting in a plan to construct a bypass tunnel to ensure the safety of general traffic.

This article will report the results of the disaster recovery for a new sharply curved bypass tunnel in order to maintain the existing tunnel portals and avoid the landslide zone.



写真は分岐部充塡閉塞完了状況

掲載頁 15

付加体からなる四万十帯をトンネル群にて貫く
―国道56号片坂バイパス　拳ノ川トンネルほか―

国土交通省　南原　道昭

付加体からなる四万十帯におけるトンネル掘削時の変状事例は，これまで多く報告されており，四万十帯は当初の想定以上にトンネル施工時にさまざまな対応を要する地質帯の一つと言える．

本稿では，高知県西南地域における３トンネルの施工実績を踏まえ，同じ地質帯に属するトンネル掘削時の施工実績および得られた知見(設計と施工時の乖離)について報告するものである．

Building Tunnels through the Shimanto Belt Composed of an Accretionary Prism― the National Route 56 Katasaka Bypass, the Kobushinokawa Tunnel, Etc.―

By Michiaki Minamihara, Ministry of Land, Infrastructure, Transport and Tourism

Many examples of deformation during the tunnel excavation through the Shimanto belt composed of an accretionary prism have been reported until now, and the Shimanto belt is considered one of the geological zones that required various measures than initially expected during the construction of the tunnel.

In light of the construction results of the three tunnels in the southwest region of Kochi Prefecture, this article will report the results and knowledge (variance between design and construction) gained during the 3 tunnel excavations in the same geological zone.

写真は切羽崩落状況

掲載頁 35

高精度電子雷管を用いた制御発破による振動・騒音対策
―宮古盛岡横断道路　手代森トンネル―

国土交通省　佐々木　稔

宮古盛岡横断道路手代森トンネルの盛岡側坑口部では，約200mにわたって土かぶり20～35mで地表に複数の民家が存在したため，発破振動・騒音の抑制が課題であった．そこで，高精度電子雷管を用いた制御発破による振動・騒音対策を実施した．発破時に地表における振動・騒音測定と周辺住民へのヒアリングを行った結果，この対策により，発破振動の大きさと振動継続時間を抑制できるだけでなく，卓越周波数を制御することで体感上の振動レベルの低減が図れることがわかった．

本稿は，これらの施工時結果と振動・騒音測定結果から得られたさまざまな知見について報告する．

Measures for Vibration and Noise through Controlled Blasting Using High Performance Electronic Detonators ―the Miyako Morioka Odan Road, the Teshiromori Tunnel―

By Minoru Sasaki, Ministry of Land, Infrastructure, Transport and Tourism

Due to the fact that multiple private houses existed on the surface of the ground 20 to 35m above the Teshiromori Tunnel, a part of the Miyako Morioka Odan road, within about 200 meters from its portal of the Morioka side, there were issues involving blasting vibration and noise control. To resolve these issues, measures against vibration and noise were implemented with controlled blasting using high performance electronic detonators. As a result of monitoring noise and vibration on the ground surface during the blasts as well as interviews of the local residents, it was revealed that these measures would not only control the vibration greatness and vibration duration time of the blasting, but also reduce the bodily sensation of the vibration levels through controlling the dominant frequency.

This article will report the various knowledge obtained from these construction results and noise monitoring.

写真は高精度電子雷管装薬状況

掲載頁 47

2函同時沈設による大型ニューマチックケーソン施工
―東京下水道　千住関屋ポンプ所―

東京都　武見　敏靖

千住関屋ポンプ所は東京都足立区千住地域に位置し，近年増加している局地的豪雨の発生などに伴う雨水流出量の増大に対応するために設ける新雨水ポンプ所で，千住地域の雨水を吸揚し隅田川に放流するための施設である．当該地はマンションなどの集合住宅に囲まれた地域であることから，地域住民と作業時間制限(8：00～18：00)，工事関係車両の搬入台数制限(200台以下/日)および工事関係車両の通行ルート制限などの工事協定を締結した．また，そのうえで事業成果の早期発現のために大幅な工事期間の短縮が要請され，西側(2,614m^2)と東側(2,289m^2)の大型ニューマチックケーソン2函体を離隔2.0mの近接で，50m以上の同時沈設を行う世界初の試みに挑戦することとなった．

本稿は，2函同時沈設による大型ニューマチックケーソン工事の概要と，種々の技術的課題を解決しながら短工期を実現した事例について述べたものである．

Simultaneously Sinking of Two Large-Scale Pneumatic Caissons― Tokyo Sewerage System, the Senju Sekiya Pumping Station―

By Toshiyasu Takemi, Tokyo Metropolitan Government

The Senju Sekiya Pumping Station, located in the Senju district of the Adachi city in Tokyo, is a new stormwater pumping facility that was established to take a measure for increasing stormwater outflow caused by heavy rain in the local region and to discharge rainwater into the Sumida River after temporary retention. Because the site was surrounded by housing complexes such as apartment buildings, a construction agreement was established with the local residents which restricted the working hours (8：00-18：00), number of construction-related vehicles that could be delivered (less than 200 vehicles/day) and traffic routes for the vehicles. In addition, a significantly reduced construction period was requested in order to start service early, and two large-scale pneumatic caissons on the west side (2,614m^2) and east side (2,289m^2) separated by a close proximity of 2.0m were simultaneously sunk more than 50m for the first time in the world.

This article will provide an overview of the simultaneous sinking of two large-scale pneumatic caissons and describe an example of a case where a short construction period was achieved while resolving various technical issues.

写真は現場全景

世界で初めて液化CO_2凍結工法を海底シールド到達防護に採用
―石狩湾新港発電所１号機放水路トンネル―

北海道電力(株)　畠田　大規

北海道電力(株)は，石狩湾新港発電所１号機新設工事を進めている．このうち放水路トンネル工事は，掘削外径ϕ5.44m，セグメント内径ϕ4.7mのシールドトンネルを泥水式シールド工法により施工し，海底面下に沈設した放水口へ接続する工事である．

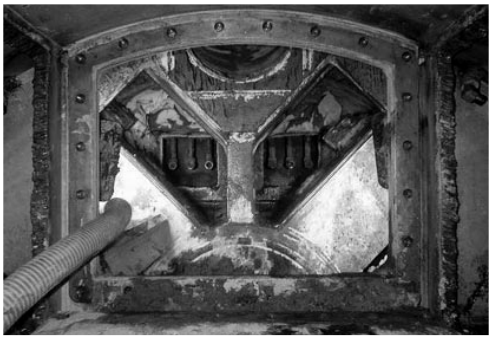
海底地盤中に到達するうえで，品質管理および安全管理の精度向上を目的として，トンネル内作業の位置検知システムの構築・運用，CIMを活用したシールド掘進管理システムの開発・導入，真円度自動測定システムによる組立て管理，到達位置探査およびCO_2を用いた新しい凍結工法などを採用した．本稿ではCO_2を用いた新しい凍結工法による到達防護工の施工実績について報告する．

The World's First Freezing Method Using Liquefied Carbon Dioxide Adopted for Protection at TBM Arrival ― Ishikari Bay New Port Power Plant Discharge Tunnel―

By Daiki Hatakeda, Hokkaido Electric Power Co., Inc.

Hokkaido Electric Power Co. is progressing with the construction of the No.1 Ishikari Bay New Port Power Plant. The discharge tunnel works consist of building a tunnel with an excavation diameter of ϕ5.44m and a segment inner diameter of ϕ4.7m using slurry shield TBM and connecting it to a water outlet that was immersed down to the surface of the seabed.

In preparation for TBM arrival under seabed, we adopted the followings for the tunnel works: constructing and operating a position detection system, developing and installing a TBM excavation management system, assembly management with a circularity automatic measurement system, arrival position investigation and adopting a new freezing method using CO_2 for the purpose of improving the precision of the quality and safety control. This article will report the results of the arrival protection with the new freezing method using CO_2.



写真は放水口側凍結管接続部の状況