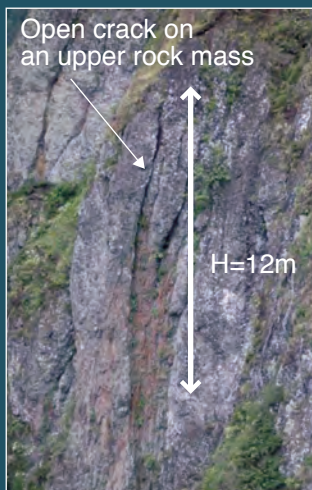


Stability Evaluation of Dam Surrounding Rock Mass and Environmentally-friendly Measures

ダム周辺岩体の安定度評価と環境に優しい対策

▶ Background of project



Typical rock mass

Completed in 1972, Hoheikyo Dam is the largest arch-type structure of its kind in Hokkaido. Over forty years after its construction, weathering was found to be progressing on the cliff at both sides of the dam body. This led to concerns about possible rock mass failures or other hazards in the future. As the dam is a popular tourist site, investigation and design work were conducted as part of preemptive disaster prevention efforts.

The utilization of new technologies in this study enabled the implementation of environmentally-friendly countermeasures.



●プロジェクトの背景

豊平峡ダムは昭和47年に完成した北海道最大のアーチ式コンクリートダムで、札幌市民の水瓶として機能する一方、支笏洞爺国立公園に位置し、多くの観光客が訪れる景勝地でもあります。

しかし、建設後約40年が経過し、堤体両岸の急崖岩盤斜面における風化進行が認められ、岩盤崩壊等による人的被害や堤体損傷が懸念されたことから、災害の未然防止のため対策が実施されました。

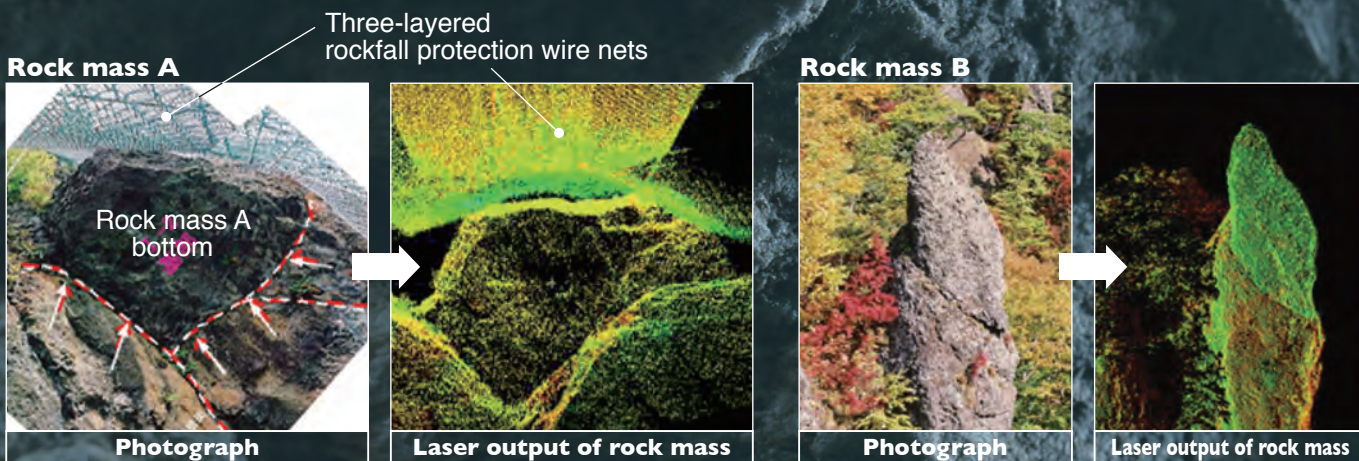
▶ Rock mass 3D shape determination using high-density lasers

To appropriately evaluate the stability of a dangerous rock mass, it is firstly necessary to accurately determine its shape and size.

This technique is a system that conducts laser ranging at a close distance and multiple points. With this method, it is possible to make high-speed, high-precision 3D measurements. In particular, using high-density irradiation, the shape of the rock mass covered by the rock net could also be ascertained by permeating the net.

●地上型3次元レーザープロファイラによる岩体の精密測量

本技術は近距離かつ多点でレーザー測距を行うシステムであり、3次元での高速、高精度の計測が可能です。特に高密度のレーザー照射により、ロックネットに覆われた岩体もネットを透過して形状や大きさを把握できます。

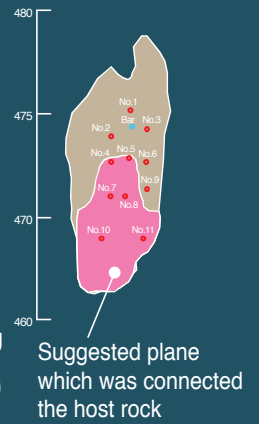


▶ Rock mass back-crack investigation using the high-frequency impact elastic wave method

This technique is one form of non-destructive probing, and is a probing system that uses the basic principle of the impact elastic wave method. Although the same shockwaves as the conventional impact elastic wave method are used, it is possible to estimate the locations of cracks in the rear surface of the rock mass more clearly by measuring the propagation time and setting the P wave speed, focusing mainly on high-frequency reflected waves in the rock mass.

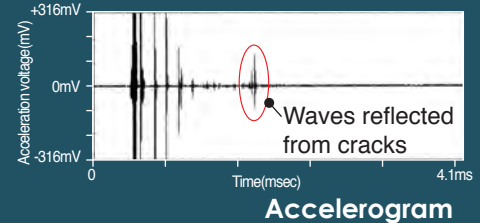


Situation of impacting the rock surface with a hammer(for trigger)



●高周波衝撃弾性波法による岩体背面亀裂評価

本技術は非破壊探査の1つで、衝撃弾性波法の基本原理による探査システムです。従来の衝撃弾性波法と同じ衝撃波を用いますが、主に高周波数の反射波に着目した伝播時間の測定とP波の速度設定により、岩体背面の亀裂位置をより明瞭に推定できます。

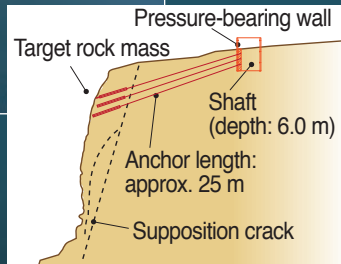


Accelerogram

▶ Anchors were driven from behind a large rock mass



A special feature of this engineering method is that anchor components are not exposed to the rock face, as a shaft is created in the rear bedrock, and a pressure plate is installed inside the shaft. Since the rock mass surface is not altered, the natural appearance is preserved with no differences to its original state. This construction work on a single rock mass is the first to take place in Japan.



Cross section

●岩体の背後から緊結する逆アンカー工法

本工法の特徴は、背後岩盤に立坑を設け、その内部に受圧板を設けるため、斜面にはアンカー部材が露出しません。岩体表面を改変しないため、現況と相違ない自然の外観がそのまま保持されます。単体の岩体での施工は国内初です。

▶ Restoring the Natural Slope -- Project Results in terms of Whole View of Rock Slope

The rock net that had been covering the rock slope was removed, and the attractively rough surface of the rock was restored to its original condition.

●岩盤斜面全景で見るプロジェクト成果

岩盤斜面を覆っていたロックネットは撤去され、元来の美しく荒々しい岩肌が復元されました。



The rockfall protection wire nets which covers the base rock slope



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