

Construction of Bypass Contributing to Environmental Protection of the Oirase Stream

— Environmentally Friendly Tunnel Construction in National Parks —

Nozomu TAKAHASHI ▶ Director of Kumano Second Tunnel Work Office, Nagoya Branch, Kumagai Gumi Co.,Ltd



1. Introduction

Lake Towada, which straddles Aomori and Akita Prefectures, and the 14 km-long Oirase Stream, which flows out of Lake Towada, are among the most scenic spots in Towada-Hachimantai National Park.

The Oirase Bypass is a road project designed to preserve the natural environment of the Oirase Stream and build a safe road (Fig. 1). There are numerous waterfalls in the Oirase Stream, and the bypass route was selected so as not to affect these waterfalls, and construction began with a tunnel section of approximately 4.6 km.

This paper reports on the efforts made in consideration of the surrounding environment during the construction of the tunnel in a specially protected area of the national park.



Fig. 1 Bypass location

2. Outline of the construction

In this work, an evacuation tunnel for the Aobuna-Yama Tunnel, which occupies a large part of the Oirase Bypass, was constructed with an excavation length of 4,573 m. The bedrocks were composed of lake sediments and tuff deposited by large-scale pyroclastic flows, and on top of these various ejecta from the Towada Volcano deposited and were generally loosely consolidated with abundant groundwater stagnated in the area, presenting concerns about sudden gushing water during tunnel excavation.

The evacuation tunnel has a small cross section (Fig. 2) and excavation was mainly carried out by mechanical excavation. Different excavators were used according to the geological conditions to ensure efficient excavation.

Drainage boring was incorporated into the construction cycle to check the geological conditions and prevent face collapse due to sudden water inflow. In implementing the drainage boring, groundwater level and waterfall flow rate were observed in real time to assess whether and to what extent

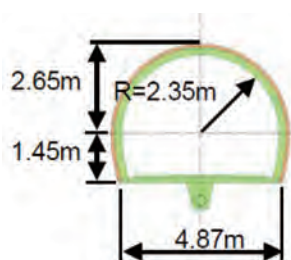


Fig. 2 Standard cross section

the tunnel excavation would change the groundwater flows and affect the numerous waterfalls in the Oirase Stream. The maximum water flow rate from the drainage borehole was 800 l/min, and these springs were connected to the piping for clean water to separate the clean and polluted water. At the time of completion of drilling, the amount of fresh water treated from the drainage boreholes was approximately 35 m³/h, which accounted for 25% of the amount treated by the turbid water system (approximately 115 m³/h) in the aim to reduce the environmental impact on the Oirase River.

3. Adoption of environmental-friendly construction equipment

(1) Turbid water treatment facilities

Discharged water that was treated by the turbid water treatment facility and satisfied the discharge standards was discharged into the Oirase River downstream of the Oirase Stream via the environmental protection public sewage facility. Among the discharge standards for the discharge water, the amount of suspended solids was set to 40% (10 mg/ℓ) or less of the environmental standard at the outlet. As it was difficult to meet the discharge standard for suspended solids with the normal turbid water treatment system, a sand filtration system was added to the system. Another facility was added to return the treated water automatically to the raw water tank for reprocessing if the water in the final treatment tank exceeded the discharge standard (Photo.1).

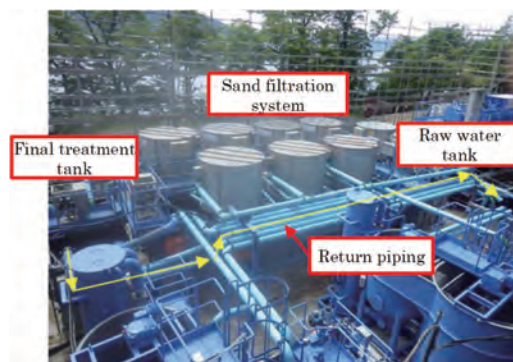


Photo 1 Turbid water system

(ii) Shotcrete

While shotcrete is generally used in a 'wet' method, there were concerns that the large amount of highly alkaline sewage would be discharged when washing the spraying plant, agitator trucks and spraying machines and might affect the environment. Instead, therefore, a 'dry' method, which does not require washing with water, was used to reduce environmental impacts on the discharge sites.