Japan's Largest Waterway Tunnel, which Reduces The Discharge of up to 600 m^3/s

— Amagase Dam Redevelopment Project, Construction of Stilling Basin and Others —

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Introduction

The main purpose of the Amagase Dam Redevelopment Project is to strengthen the flood control function by increasing the dam discharge capacity from the current maximum of 900 m^3/sec. to 1,500 m^3/sec. Most of the tunnel discharge facilities are built underground to preserve the landscape (Fig.1). Of these, the stilling basin dissipates the discharged water from the main gate (up to 600 m^3/sec. at a water pressure of about 50 m in height difference) before it flows into Uji River. Based on the hydraulic model experiments, the stilling basin is designed to have an extremely large cross-section with the inner space of up to 500m^2, although its total length is as short as about 170 meters (Fig. 2).

Fig. 1 Layout of tunnel-type discharge facility

1. Characteristics of The Project

First of all, the stilling basin has an extremely large cross-section. Secondly, its geography and geological conditions are such that the overburden depth is about 40 meters, the overburden ratio is small (about 1.5 D) and a sharply defined F-0 fractured zone of about 10 meters in width crosses at about 80 meters from the entrance of the tunnel. Since the cross-section is extremely large, the effect of displacement and stress generated in the weak layer have strong impact on it and thus new reinforcement work is required especially for the F-0 fractured zone. As a result of the examination, the method to construct a column-shaped downward large forepiling (hereafter referred to as "RC pillar supports") by caisson type pile work on the outside of the cavity main body sidewall was newly conceived to reinforce the section with

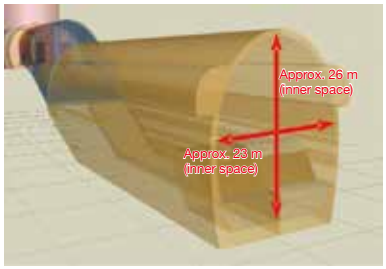

Fig. 2 Completion image of stilling basin

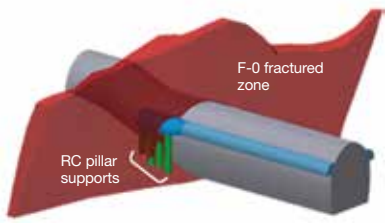

Fig. 3 Layout of RC pillar supports

fractured zone crossing (Fig. 3).
The third characteristic is the complicated construction step requiring the repetition of excavation and lining. The side drift excavation, construction of RC pillar supports and concrete lining for sidewall drift were carried out in advance, and the top heading construction is completed by the arch excavation and arch lining. After that, bench excavation (bench height 3 meters) is carried out for the lower half, and a bottom plate and a side wall are constructed to complete the waterway tunnel.

2. Computerized Construction

For an extremely large section like this, it is crucial to carry step management, such as observing the change of the geology, measuring and monitoring the ground behavior, checking the support structure, and main body structure at each construction stage against the predicted value and making adjustments. Therefore, computerized construction is carried out during the excavation, with observing the tunnel face and the wall surface and constantly measuring the ground behavior and the stress generated at the supports and lining by geology experts. In lining concrete as well as excavation, pressure gauges are installed on the travelling form to check whether the concrete pressure is appropriate for the actual lining thickness, thereby preventing the generation of void behind lining. In addition, a computerized construction method is adopted in such ways as confirming whether a form has reached the standard strength for demolding by automatically measuring the accumulated temperature.
At present, the bench excavation has been completed to the third stage, and the bench excavation and lining work for the remaining four stages (H = 11.5 m) are to be conducted. The construction will be carried out safely while feeding back various data of the construction to the next step.

Photo 1 Bench excavation, 3rd stage