Maintenance of Historical Sabo Facilities by the Tateyama Mountain Area Sabo Office
- An Evaluation of the Soundness and Utility of Sabo Facilities -

Hisashi WATANABE[1*]

[1]Chief Researcher of Sabo Frontier Foundation, Japan
*Corresponding author. E-mail: kenkyu2@sff.or.jp

INTRODUCTION

Sabo work in Tateyama started in 1906. The initial Sabo works were executed by Toyama Prefecture, but were taken over by the Japanese Government in 1926. Over the last 90 years, there have been advances in the techniques used for Sabo works and some of the Sabo dams in Tateyama are made of materials, structures, and construction methods that are no longer used. Several Sabo dams have been certified as cultural properties by the Agency for Cultural Affairs, based on their historical or cultural value. This paper introduces recent efforts by the Tateyama Mountain Area Sabo Office to maintain the Hongu Sabo Dam (Fig.1), which is a large Sabo dam located in the middle reach of the Joganji River that has been designated a cultural property.

THE HONGU SABO DAM

The Hongu Sabo Dan is a large check dam that was constructed in the middle reach of the Joganji River, one of the steepest rivers in Japan (The average bed slope is about 1/30). The dam is 22.0 m high, has a crest length of 107.0 m, a volume of 37,000 m^3, and a sediment trap capacity of 5million m^3, the largest in Japan. In recent years, improvements have been made to enhance the environment around the Hongu Sabo Dam, which was made in the days before mechanized equipment. To save cement, the front and crest of the dam were made of stone, and rubble concrete was used inside the dam (Fig.2). The construction of the Hongu Sabo Dam required large tower cranes and chutes, and rubble concrete, which were state-of-the-art equipment, materials, and methods of the time (Fig.3). Despite its size, the dam was completed in less than 2 years.

Fig. **1** Hongu Sabo Dam

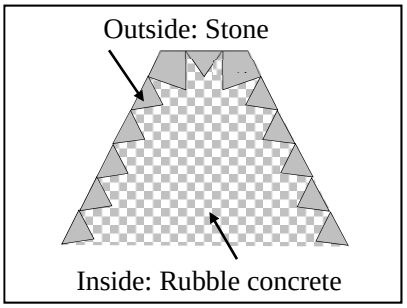

Fig. **2** Rubble concrete dam

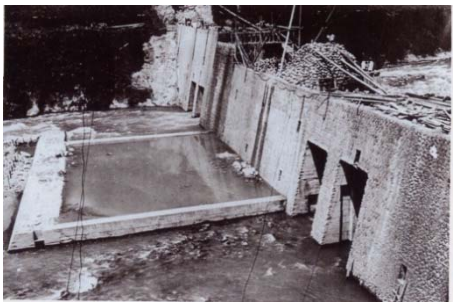

Fig. **3** Under construction

SOUNDNESS OF THE SABO FACILITY

The rubble concrete inside a rubble concrete dam may be of poorer quality and weaker than modern ready-mixed concrete although, if the outer material (stone, etc.) is not damaged, the dam

will not fail catastrophically. In other words, the soundness of rubble concrete dams depends largely on the state of the outer materials (stone, etc.).

Recent inspections found that some stone was missing or abraded at the crest of the dam, and the internal material was exposed. There is always water flowing over the dam, and the details of the damage to the outer stones at the crest of dam or front of the dam cannot be determined in a normal inspection. Further, the documents with information about the design of the Hongu Sabo Dam were burned during the Toyama air raid in World War II. Thus, we could not obtain information about the materials used to construct the interior of the dam. Therefore, to evaluate the soundness of the dam as a disaster-prevention facility, and to promote its maintenance and management, a survey was conducted (Table 1). Using the information obtained in these investigations, we evaluated the current stability of the Hongu Sabo Dam.

Table 1 Items investigated

Investigation method	Investigation aims	Supplement
Boring investigation (includes laboratory tests)	Physical properties of the internal material of the dam and sedimentation area	Six representative locations
Detailed visual inspection	Damage or deterioration of the outer stone material	Divert the flow Rappel down the dam
Elastic wave exploration	Density of the internal material	Eight representative sections

RESULTS AND EVALUATION

Factors affecting dam function[2]

The stone at the crest of the dam and the mortar in the joints were abraded. No damage to the stone at the upstream or downstream sides of the crest of the dam was seen. The seven central rows of stone and mortar at the crest of the dam were missing, over a maximum area of 2 × 2.5 m and 0.4 m deep. Nevertheless, the boring and elastic wave tests showed that the rubble concrete inside the Hongu Sabo Dam was very dense and we determined that the possibility of instantaneous failure of the dam was low.

Factors affecting dam performance[2]

Although the ground strength of the dam site and the conditions for the stability calculation remain unknown, from a comprehensive point of view, our evaluation is that there is no danger of catastrophic failure because the dam did not fail during a major flood in 1964 and the dam is currently full of sediment.

[2] The performance of a Sabo facility is defined as the structural safety of it; the function of a Sabo facility is defined as its ability to prevent sediment-related disasters.

CONCLUSION

In recent years, the environment surrounding Sabo works has changed greatly. With the increasing costs of social security, maintenance costs are expected to increase. To maintain and improve safety in the region, effective utilization of existing Sabo facilities, including historical Sabo facilities, is required.

Keywords: Evaluation of the soundness; Maintenance; Historical and Cultural value; Rubble concrete; Utilization of Sabo dams