Measures to Reinforce the Left Bank Part of the Shiraiwa Sabo Dam

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THE SHIRAIWA SABO DAM

Because of the Hietsu earthquake that occurred in February 1858, Mt. Tonbiyama in the Tateyama Caldera located in the upper basin of the Joganji River collapsed and formed a landslide dam. Twice, in March and April, the landslide dam broke down into a debris flow and the flood disasters occurred in the Toyama Plain, which is the lower area of the Joganji River. Since then, large amounts of sediment remained in the Tateyama Caldera, and it became an environment where lots of sediment flowed out every rainfall, raising the bed of the Joganji River, and causing flood damage to the Toyama Plain.

In order to prevent the outflow of sediment remaining in the Tateyama Caldera, it was effective to construct a Sabo dam at the exit of the Tateyama Caldera, which is a constricted part. Although, the valley bottom of this narrow part was divided into right and left by a thin ridge, and the riverbed on the left bank side had been under degradation. Therefore, the left bank side was closed to keep the riverbed high at the Tateyama Caldera exit, and the Sabo dam was located on right bank side bedrock region. As a result, the design of Sabo dam became a complex structure with the central part, and the left bank part. The present Shiraiwa Sabo Dam has been constructed by utilizing part of Yukawa First Sabo Dam, which suffered by repeated debris flows, and was completed in 1939: eight years from the start of construction.

STRUCTURE OF THE LEFT BANK PART

At the left bank part, which had to shut off the riverbed, the revetments were built approximately 40m high and were connected to the wing of Sabo dam. In addition, the downstream side of the revetments was located at the steep slope banking, the surface was reinforced by wooden mattress, and the foot of the banking was reinforced by the retaining wall. In 1937 before the completion, landslide occurred at the mountain slope beside the left bank part, and the sediment was deposited, partly destroying the structure of the woodwork mattress. Therefore, the checkerboard frames were installed on the surface to keep stability of the surface of the steep slope banking.

MEASURES TO REINFORCE THE LEFT BANK PART

There was no deformation of the left bank part of the Shiraiwa Sabo Dam after the completion for a long term, and stability was kept. But from about 1988, when approximately 50 years passed after construction, examination of the reinforcement by the deterioration was started. In the examination, spring point investigation, groundwater level observations, and water quality tests were carried out. It was grasped that the groundwater of the left bank part were mixed by that derived from the mountain slope beside the left bank part and the penetration water from the river of upper reaches, and its mixture ratio of each spot. Based on these examination, the counterweight fill and two water catchment wells were constructed as the facilities which plans to keep the long-term stability of the left bank part by 2009 (cf. **Figure 1**). Also the boring

direction of the water catchment well was decided to cover a wide area and depth to remove the groundwater from mountain slope beside the left bank part as well as the groundwater from the river direction.

THE LEFT BANK PART AND RECENT ACTION

At the left bank part, the observation and the investigation, such as the groundwater level observation, the slope variation detection by the borehole clinometers, and the periodic inspection to confirm presence of deformation, such as cracks are carried out continuously at present. As a result of these investigations, there were no signs such as cracks which imply the outbreak of the landslide. In addition, according to the observation data of the groundwater level, tendency to drop is seen after the construction of the catchment well, and the catchment situation of the catchment boring is good, too.

In the future, when groundwater level rises, it is important to carry out water quality tests to grasp the causes such as changes of the water path, in addition to above-mentioned investigations and observations. In 2016, water quality tests for each depth and directions of the catchment borings were carried out newly, and a present mixed ratio of the two different groundwater derivations were grasped.

Continuous investigations and observations are going to be executed to utilize it as basic data to examine the need of the maintenance measures of the catchment well and additional reinforcement measures of the left bank part.

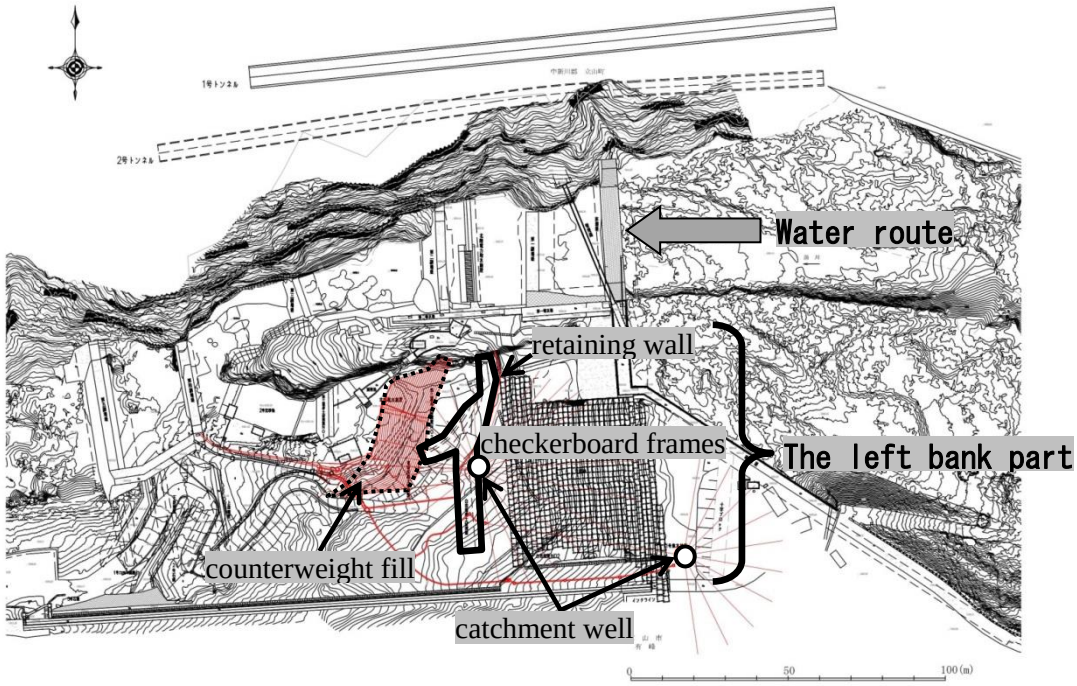

Fig. 1 The Shiraiwa Sabo Dam and the left bank part

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