Sediment Disasters and Progress of Sabo Projects in Japan

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Introduction

Natural and social conditions of Japan inevitably make it prone to sediment disasters because its flatlands are limited, river gradient is steep, earthquakes occur frequently, and communities have often formed near mountains. Consequently, in order to protect the human lives and social infrastructures against sediment disasters, *Sabo* projects have been implemented since early times, and the technology has been developed along with the progress of the times. On the other hand, sediment disasters accompanied by extreme weather have recently been on the rise in the context of climate change.

In this report, the author looks back on the past history of sediment disasters and the Sabo projects in Japan, and at the same time, based on recent disasters, gives contemporary issues concerning the countermeasures against sediment disasters and the challenges for the future.

History of Sabo dams in Japan

1. Before the Meiji Government (before 1868)

Up to about 100 years ago, mountains which had little vegetation or trees were seen everywhere in Japan. This was the result of many years of continuous logging to use the wood for buildings and fuel. Therefore, administrations in power during those times very frequently issued official notices prohibiting the logging. However, in practice, prohibitions on the logging were difficult to enforce. So that, in many places, it continued and caused sediment discharge.

2. After the Meiji Government (after 1868)

A new Japanese government—the Meiji Government—invited engineers from Holland, Austlia, and other countries that had advanced erosion and sediment control technologies at that time, and proceeded to import them to prevent sediment disasters. Apart from such technology transfer initiatives, Japanese engineers proceeded to establish *Sabo* technology particular to the natural and social conditions in Japan by fusing the imported technologies with the Japanese traditional technologies that had been developed up to then.

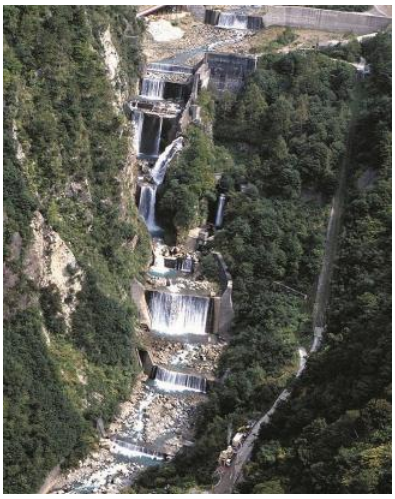

Photo 1 Main dam and secondary dams of Shiraiwa Sabo dam

3. Importance of historic Sabo structures as viewed through the Shiraiwa Sabo Dam

1) Sabo technology exemplified by the Shiraiwa Sabo Dam

The Shiraiwa Sabo Dam located on the Joganji River, famous steep river in Japan, represents the Sabo technology unique to Japan. The construction of this dam began in 1931 and continued

for 8 years. It has the height of 63 m, the highest Sabo dam in Japan. At the time the construction was completed, two secondary dams had also been constructed. Subsequently, however, because the riverbed degradation in the downstream portion of the dams had progressed, a total of seven secondary dams have been constructed, and the total height from the top of the main dam to the bottom of the lowest secondary dam now reaches 107 m (**Photo 1**). The technologies utilized to construct the dam was so advanced that they could be utilized even in the present day.

Photo 2 Narrow-gauge rail way

In addition, because the route to the dam site was steep, a narrow-gauge railway track of about 18 km was laid to transport the construction materials in the early time. It is still in service today (**Photo 2**).

2) Regarding the values of historic Sabo structures

Historic Sabo structures have important values in terms of their: i) scientific value, ii) landscape and environmental value, and ii) publicity value. Scientific value signifies the history of the valuable technology that was practiced at that time under the severe natural conditions that existed in the country. Landscape and environmental value signifies that the structures harmonize with and blend in with the surrounding nature in a beautiful way. And, the publicity value signifies the role of the structures as objects that are appreciated by people and their function of enhancing the people's understanding of Sabo projects.

Sediment disasters and their challenges in Japan in 2018

Large-scale sediment disasters occurred over extensive areas in western Japan in July 2018. Record-breaking precipitation data were recorded at many points of Japan. As a result of the rain, about 1800 sediment disasters occurred and caused about 110 deaths. It was the worst sediment disasters in the past 30 years.

One of the problems raised from these disasters is that though cautionary measures, such as evacuation advisory or Sediment disaster alert, were taken by administrative authorities appropriately, it didn't lead to inhabitants' evacuation actions.

One of recent significant advancement in Sabo technology in Japan is found in the unmanned construction technology. In Japan, there is a necessity to conduct emergency work to prevent the secondary disaster even under unrest and dangerous situations such as right after volcanic eruption or earthquake. Recently, it has become possible to operate a number of heavy machines simultaneously by means of a wireless LAN. In the future as well, we can expect further advancements in the development of wireless technology and related systems.

Conclusion

As described, since early times Japan has been a nation prone to sediment disasters due to its natural and social conditions. In parallel with the development of the modern state, erosion and sediment control, or Sabo, technology unique to Japan has been developed, represented significantly by the Shiraiwa Sabo Dam. The Ministry of Land, Infrastructure, Transport and Tourism seeks to publicize the importance of Sabo projects through the value of those historic Sabo structures. In addition, in light of the fact that the severity of sediment disasters has been increasing recently, the Ministry will promote the development of related technologies like those used for unmanned construction technology.

Keywords: Extreme weather, Shiraiwa Sabo Dam, historic Sabo structures, unmanned construction technology