Examinations concerning the effects of sediment control dams at land slide flow zones

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1. Introduction

Many studies have been conducted concerning the sediment capturing functions of sediment control dams using water channel experiments and data analyses. The outcomes of these studies have been reflected in references, such as the Guideline for Establishing Sand Control Basic Plans (for debris flow and driftwood edition). Sediment control projects are being conducted based on these guidelines and references today.

Meanwhile, the challenges found through past research include the fact that although sediment outflows that flow down sediment flow zones (stream gradient: about 2 to 10 degrees) exhibit different sediment movement, such as the lowered sediment concentration unlike debris flows that flow down the origin and the down flow sections of the debris flow (stream gradient: 10 degrees or more), the sediment capturing effect of sediment control dams that would work on sediment outflows that would flow down sediment flow zones has not been sufficiently examined.

Given such circumstances, the objective of this study is set to clarify how sediment outflows that flow down sediment flow zones would affect the effectiveness of facilities such as the sediment capture function of sediment control dams. The study included reproducibility calculations based on water channel experiments and numerical simulations to satisfy the objectives.

2. Outline of this study

The water channel experiment used a square water channel with a length of 10 meters, 30 centimeters, in width and 50 centimeters in height. The gradient is five degrees, and the sand used in the experiment is prepared based on past disasters. Three patterns of hydrograph were set, including a hydrograph with a rapid start and short duration and square-type hydrographs frequently used in past studies (figure 1). The study also used a total of three types of sediment control dams, including an impermeable type that was commonly constructed today and ones with two different widths in the permeable section. The sediment was supplied at a balanced rate based on the set hydrographs.

The experiment found that the process of sediment accumulation and the process of water outflow differed depending on dam types (figure 2). Yet, the experiment found no significant differences in the amount of sediment captured by the dams in all dam types and hydrographs.

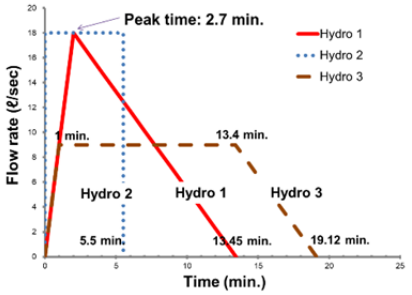

Figure 1: Hydrograph (flow rate pattern)

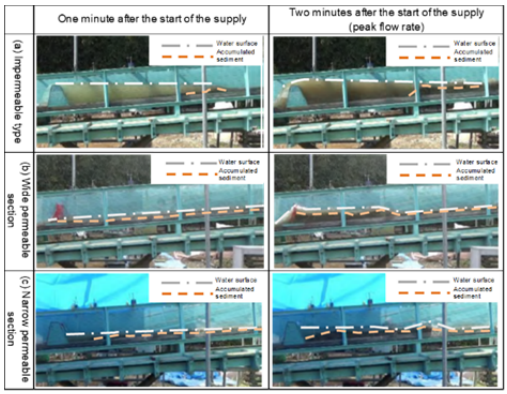

Figure 2: Accumulation process

Meanwhile, the amount of sediment outflow decreased by 80% at the peak supply rate in Hydro 1 with a rapid start and short duration when the permeation width of the permeation-type sediment control dam was narrower compared to a case in which the permeation width was wider. One of the causes was that the amount of sediment that reached the dam was smaller during the peak supply rate. The outcomes of the experiment and the outcomes of reproduction using numerical simulations are discussed in the detailed information section.

3. Conclusion

The authors are going to continue water channel experiments and data analyses to find how the differences in sediment concentration and particle size distribution would affect sediment control dams installed in debris flow sections.

☞For more detailed information

1) Civil Engineering Technology References , pp. 24-27, 2016.6