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One Dimensional Numerical Simulation on Debris Flow of Sabo Dam.

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Debris flows are the natural phenomenon in mountainous area. It is involving the fluidized flow of earth, rocks, vegetation etc. In addition to causing significant morphological changes along riverbeds and mountain slopes, debris flows are frequently reported to have brought about extensive property damage and loss of life(Takahashi 1991; Hunt, 1994; Huang and Garcia 1997; Nakagawa et al., 2002a; Shrestha 2009).

Debris flows are the flow of water and solids mixture, in which solids are the assemblage of widely distributed grains. Therefore, the essential model for the mechanics of flow should be considered, simultaneously. The rheological debris flow model depends on a variety of factors, such as sediment distribution, cohesive component, grain friction and sediment concentration. Numerical models of debris flow based on the conservation of mass and momentum of the flow have been proposed by several researchers. These models can be classified as: Bingham model(Dent and Lang 1983), Dilatant model(Bagnold 1954; Takahashi 1978), Newtonian model(Johnson 1970; Trunk et al., 1986; Hunt 1994),linear and nonlinear viscoplastic model(Johnson 1970; O'Brien and Julien 1988; Liu and Mei 1989; Huang and Garcia 1997, 1998).

However, the existing discrete element models that are suitable for discussing individual particle motion cannot treat solid-fluid interaction well, and more importantly, they cannot predict the macro behaviors practically required.

Numerical simulations are important to ensure that countermeasures will be efficient before construction. Countermeasures designed to reduce the debris flow disasters can be classified as structural and non-structural measures. Structural measures include sabo dams, guide levees and training channels, while non-structural measures include warning system, proper land use in the areas and the reinforcement of houses etc.

To prevent or mitigate debris flow disaster, many efforts are devoted by the scientific and engineering communities to design of proper device able to capture the debris flow volume. Sabo dams are one of the effective structural countermeasures for debris flow control. In fact, there are a lot of kinds of dams such as closed-type, grid-type, slit-type ect.

In closed-type sabo dam, it is difficult to prevent from losing its capturing capacity unless continuously removing sediment. On the other hand, open-type dams may keep their trapping capacity without removing the sediment.

In recent studies, experimental and numerical works have been performed for definition of general design criteria of sabo dams. Nevertheless, there are few studies discussing the debris flow model on a series of sabo dam. Depending on the conditions of arrangement of sabo dams could affect flow property of the debris flow.

The objective of this study is to suggest the analysis method of debris flow on a series of closed-type sabo dams in the numerical model. One-dimensional finite difference model(Takahashi 1992; Nakagawa 2003) for debris flows based on a dilatant-fluid model is used.

It is hoped that this study will help to determine the combination criteria of arrangement of sabo dam.