Deposition Shape of Landslide Dam

Kiyotaka SUZUKI[1*], Taro UCHIDA[1] and Wataru SAKURAI[1]

[1] SABO Planning Division, SABO Department, National Institute for Land and Infrastructure Management, Japan

[*]Corresponding author. E-mail: suzuki-k924a@mlit.go.jp

INTRODUCTION

The shape such as the height and slope gradient of the landslide dam is important because it greatly influences the storage capacity and the peak discharge due to over-topping erosion. So, to examine the countermeasure plan and map potential hazard area due to landslide dam breach in advance, the shape of landslide dam is one of key information. In this study, we examine the shape of landslide dam using airborne LiDAR data after disaster. Here we focus three disasters in Japan, the Niigata Prefecture Chuetsu Earthquake (2004), the Iwate-Miyagi Nairiku Earthquake (2008), and the Kii Peninsula Flood Disaster (2011).

METHODS

We used 1 m DEM created from airborne LiDAR data. The longitudinal survey line is set as the center line of the river channel after the formation of the landslide dam (**Fig.1**). We analyzed the longitudinal shape and slope gradient on the downstream side of the landslide dam. We examined 24 landslide dams.

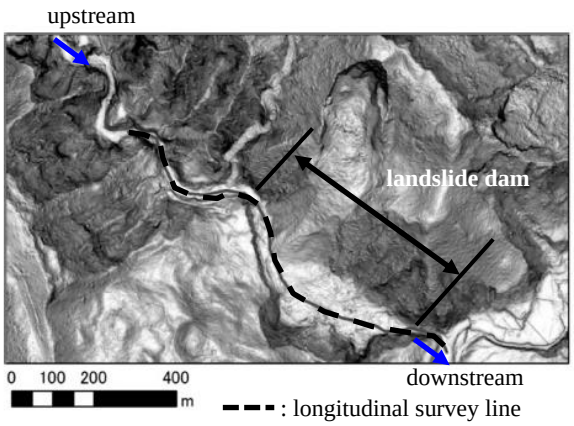

Fig.1 Example of longitudinal survey line

RESULTS

Fig.2 shows examples of the shape on the downstream side of the landslide dam. There are two types of landslide dam shape, one is the slope of upper part is steeper than the lower part (multiple type, left of **Fig. 2**), the other is the slope gradient is almost uniform (single type, right of **Fig. 2**). Ten of 24 landslide dam grouped as the first type.

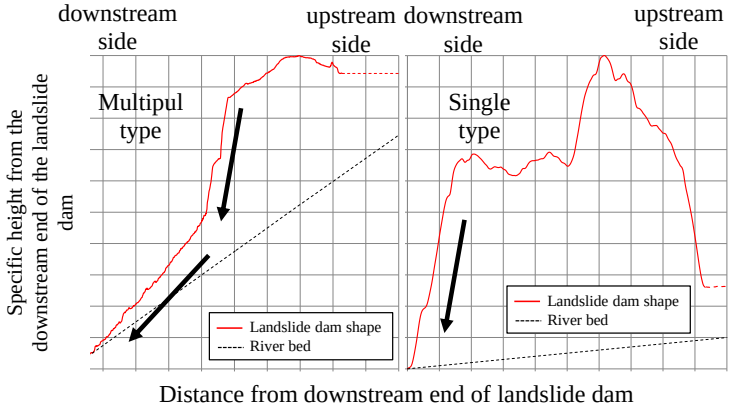

Fig.2 Example of the shape on the downstream side of the landslide dam

Fig.3 shows the relationship between total height and mean longitudinal gradient on the downstream side of the landslide dam. There was no clear relationship between height and gradient on the downstream side of the landslide dam.

Nine of the 11 landslide dams (82%) showed multiple type in cases where the height of the landslide dam exceeded 25 m. On the contrary, only one of the 13 landslide dams showed multiple type in cases where the height of the landslide dam less than 25 m.

While, there is no clear difference in mean gradient between single type and multiple type.

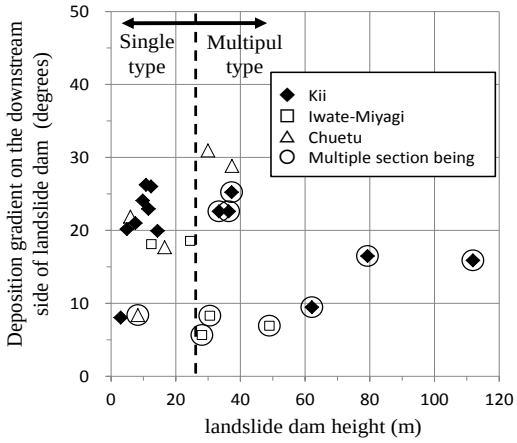

Fig.3 Relationship between total height and mean longitudinal gradient on the downstream side of the landslide dam

Fig.4 shows the relationship between the steep part height and the steep part longitudinal gradient on the downstream side of the landslide dam. Based on slope stability analysis, it can be considered that there is a limit height related to slope gradient, as shown by the broken line in **Fig.4**. The observed data were enveloped by the broken line, suggesting that the shape on the downstream side of the landslide dam should be affected by slope stability.

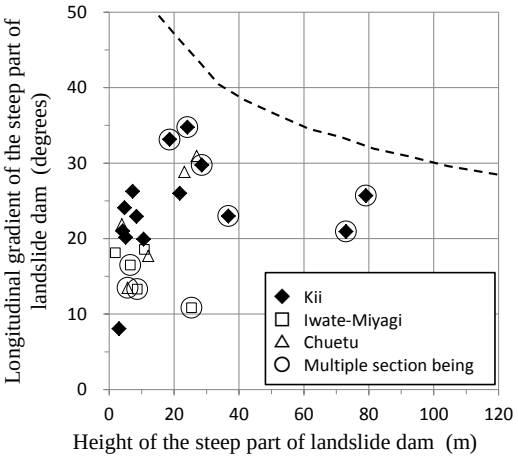

Fig.4 Relationship between the steep part height and the steep part longitudinal gradient on the downstream side of steep part of the landslide dam

Fig.5 shows the relationship between the steep part gradient and the gentle part gradient on the downstream side of the landslide dam. The gradient of single type was 18 to 31 degrees except for one case. In the case the multiple type, the steep part gradient is 11 to 35 degrees, the gradient of the gentle part is 4 to 17 degrees. The gradient of the gentle part is around half of the steep part.

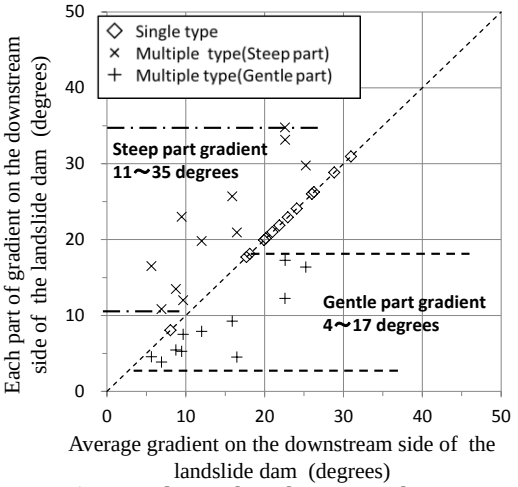

Fig.5 Relationship between the steep part gradient and the gentle part gradient on the downstream side of the landslide

CONCLUSIONS

The gradient on the downstream side and height of landslide dam varied widely, and there was no clear relationship. The shape on the downstream side of the landslide dam can be classified into two, one is single type, or the other is multiple type, and when the landslide dam height exceeds 25 m have multiple type.

Keywords: deep-seated landslide, landslide dam, deposition gradient