

The Landslide Occurred at Kokugawa Area Itakura-ku, Joetsu City

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INTRODUCTION

On March 7, 2012, an enormous landslide occurred at Kokugawa area, Itakura-ku, Joetsu City (Fig.1). The landslide reached the residential area and destroyed 4 houses. In this paper, we report initial correspondence and urgent investigation which is the first case implemented in Japan based on “the Sediment Disaster Countermeasures for Sediment Disaster Prone Areas Act”.

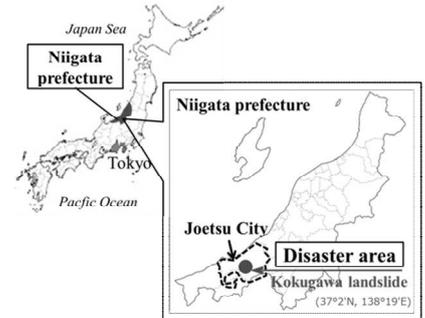


Fig.1 Location of disaster area

GENERAL INFORMATION

1. The outline of the landslide

The movement of the Kokugawa landslide became active from the afternoon on March 7, 2012. The size of the landslide is width 150m, length 500m, thickness 20m and volume 750,000m³. And the size of the toe of the landslide is about 120m width, 250m length, and 7m thickness. And 5 houses (1 vacant), 4 huts, 2 garages were completely destroyed. A prefectural road and an irrigation canal with irrigated area of 2000ha were cut off, as shown in Fig. 2, 3.



Fig. 2 The landslide at 16:00 on March 8, 2012



Fig. 3 The landslide at 11:00 on March 10, 2012

2. The characteristics of the movement of the landslide

The fundamental geology of this area is composed of the Sugawa tertiary formations. Joetsu City is known as one of the heavy-snow region in Japan. At the time when the landslide occurred, thicker snow cover than usual year remained around the landslide area. It is presumed that much snowmelt water infiltrated into the block of landslide near the sliding cliff induced the landslide.

The movement of the landslide became active since the evening of March 8. Then 1.5m of snow-pack remain at the foot of the slope where the landslide occurred. The snow-pack push by the landslide started to heave and progress, as shown in Fig. 4. Because the movement of the landslide was very slow and the landslide mass was covered with thick snow-pack, its

movement was not readily apparent. We could know it by the sound of falling down tree around the landslide area.

3. The weather conditions

Fig. 5 show the change of snow-depth and temperature during the period before and after the landslide occurrence. The temperature exceeded 10 degrees two days before the occurrence, and the snow-depth decreased rapidly. This result supports the presumption that a lot of snowmelt water was one of the major occurrence factors of the landslide.

4. The permanent counter measures

Disaster relief project for this landslide was approved by Ministry of Land, Infrastructure, Transport and Tourism on April 6. The main prevention works were groundwater drainage works, soil retaining works, channel works and soil removal works at the top of landslide. The ground water level in the landslide area decreased by these prevention works, but we suffered from muddy ground after rainfall for a few months. Even though the surface of the ground was dried, the ground remained as soft as it was because of lots of snow lump in the clod of the landslide, as shown in Fig. 6. Our prevention works were almost finished on April 10, 2013. Then the evacuation recommendation was canceled by Joetsu City that based on the result of the investigation by the specialists about the landslide. Now we are carrying out slope protection work around the sliding cliff, as shown in Fig.7.



Fig. 4 The landslide reached the house
Sekiyama (Myoko, Niigata)



Fig.6 Lump of snow contained in the clod of the landslide

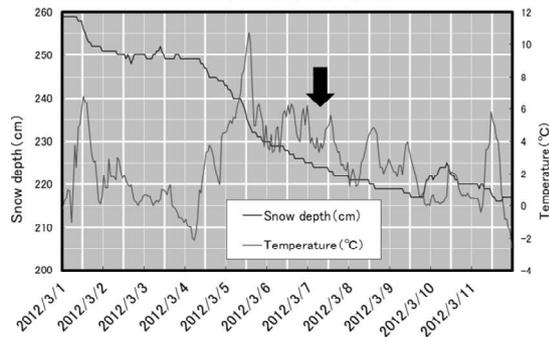


Fig.5 Relationship between temperature and snow-depth near the landslide area



Fig. 7 The prevention works

CONCLUSIONS

We learned from the experience of Kokugawa landslide that the early investigation and correspondence with renewed interests are important. We suggest that establish warning system for evacuation and to check them constantly are most effective for disaster prevention. Furthermore, the initial correspondence for the disaster occurrence is also very important. In Niigata Prefecture, we are planning to prevent the sediment related disaster more safely with preparation at usual and quick response at emergency.

Keywords: landslide, emergency measures, snowmelt water, evacuation recommendation