Provisional Report of Tsukidate Landslide Caused by the May 26, 2003, Off-Miyagi Earthquake

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INTRODUCTION

An intense earthquake, with a moment magnitude of 7.0 (Japan Meteorological Agency, **JMA**) took place at 18:24JST on June 24, 2003. The epicenter was located at latitude 38.8°N and longitude 141.8°E. Its intense shake damaged viaducts of the Tohoku Shinkansen, one of the Japan regular high-speed railways between Tokyo and Aomori, and the shake was also responsible for a landslide at Tsukidate, Miyagi (**Fig. 1**). This report briefly outlines the findings obtained through a survey at this landslide area. The survey was made laying stress on the travel distance, velocity and deformation of the landslide mass. Some descriptions in this report are not fully evidenced yet, and therefore, the reporter's comments are not yet the conclusions reached after a thorough discussion. However, providing a rough-an-ready overview will be important for taking measures for the disaster relief and precautions against possible secondary disasters.

Figure 1 Source (left) and deposition (right) zones:

LANDSLIDE CONFIGURATION

Tsukidate sliding surface was surveyed using a laser-based theodolite (Laser Ace 300) connected to a portable computer. The theodolite has a built-in digital compass, and with its laser beam it determines the azimuth, dip angle, and horizontal distance to a point. The horizontal distances from the top end of the scar to the toe of the slope and to the farthest reach of the soil mass are 100m and 180m respectively. The landslide descended 27 m over a horizontal distance of 180 m. The average inclination from the top of the source area to the toe of the deposit is about 6-7 degrees (see **Fig. 2**).

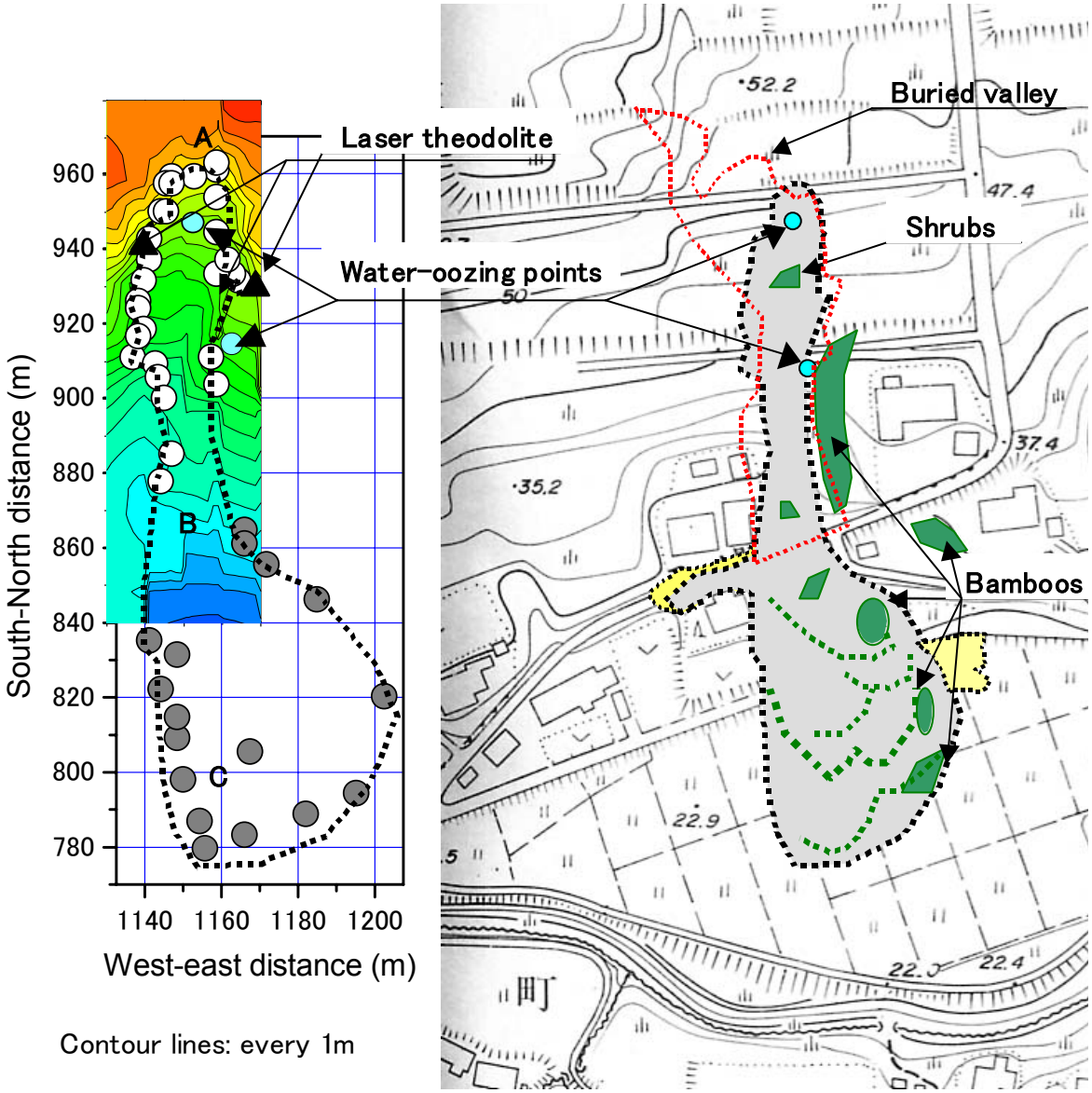

Figure 2. Landslide configuration

Dimension:
Length: about 180m from the top scar to the distal end of the landslide mass
Width: maxim 60m (deposition area)
Inclination: 7° between A-B, 3° between B-C

Date of measurement:
Longitudes and Latitudes along the perimeter of the landslide area: May 27, 2003
3D form of the landslide area: May 30, 2003; the entire area was covered with plastic sheets in preparation for typhoon at this moment.

Landslide mass:
5000 - 10,000 m^3: For more exact evaluation, configuration of the sliding surface must be measured.

Figure 3. Aerial photos of the landslide area (see black arrow).
(photographed in June, 1962, provided by Active Fault Research Center, AIST)

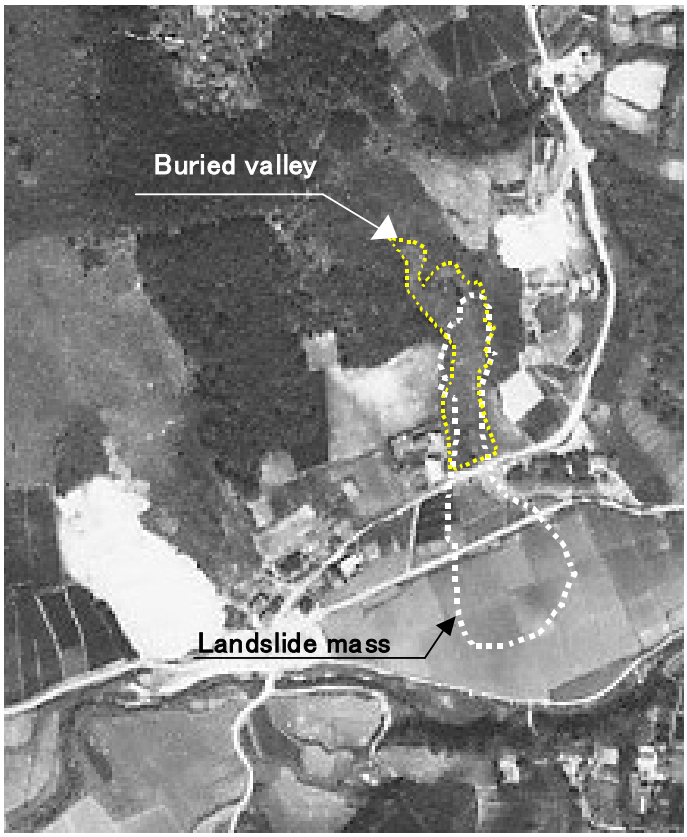

Figure 4. Landslide area (white broken line) and buried valley (yellow broken line)

Figure 3, a pair of aerial photographs taken in 1962, is perceived as a single image in terms of depth, and a valley is seen cutting in a hillside. This valley was filled in for cultivation, and the landslide took place exactly along this valley (**Fig. 4**).

Figure 5. Marks of landslide mass (middle) and spatters (below) remaining on mortar block wall

LANDSLIDE VELOCITY

Figure 5 shows a mortar block wall of a dwelling on the western perimeter of the landslide deposit. Mud spatters on the wall follow some parabolic shapes. One parabola goes 8.6 cm upward and reaches it peak after about a 40 cm horizontal run. This geometry suggests that the time, t, needed for the splashes to reach their peak height Δh (8.6 cm) was about 0.132s ($\Delta h = g \cdot t^2 / 2$). During this time the splashes ran about 40 cm horizontally, indicating a horizontal speed of about 3 m/s. The estimated velocity is for the western edge of the landslide mass. Judging from bamboos and other plants carried by the landslide mass (Fig. 1), the mainstream may have flowed about two times as fast as the edge stream.

SUMMARY

The Tsukidate landslide mass showed peculiar features of long-traveling soil flow. The landslide seems to have taken place where a valley was filled in for cultivation. The landslide configuration was measured by using a laser-based theodolite, and a possible velocity of the main stream was estimated to be 6-7 m/s from mud spatters remaining on a wall and patterns of plants carried by the landslide mass. More details will be reported in later publications.