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Automatic total station as a useful technique to detect unstable slopes in S. Miguel Island (Azores). A case study in the Povoacao village

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The Azores archipelago is located in the North Atlantic Ocean and it is composed by nine volcanic islands. S. Miguel is the largest one and during its five hundred years of history has been affected by several destructive landslides triggered either by earthquakes, volcanic eruptions and heavy rainfall episodes.

With the main goal of detecting small soil movements preceding larger instabilities in landslide prone areas, a geodetic monitoring program was established in the Povoação village, using an automatic total station.

The test site is located in the cut of the main regional road and it is named “Talude da Estrada Regional” (“Regional Road Slope”). The study area is a steep slope cutting pumice deposits and is susceptible to the occurrence of both rotational and translational slides. Present-day slope instability is confirmed by the slope geometry and ground cracks. In April 2004, 18 benchmarks were installed in the slope at a distance from the base station ranging from 40 to 125m. In order to detect small movements and monitor the evolution of the surface displacements seven survey campaigns were performed between April 2004 and November 2005. The maximum displacement rate observed in the area was about 23 mm in 11 months (from December 2004 to November 2005). The average accuracy achieved during the total station measurements has been evaluated to be 1 mm in both horizontal and vertical components.

In this work, we present the total station data surveys and the discussion of seven cam-

paigns carried out during the time span of 19 months, in order to evaluate instability scenarios. Until now, damages provoked by slow movements are not heavy and can be easily fixed. However, the most probable future scenario will be the quick rupture in the soil and the acceleration of the movement, triggered by an extrinsic factor, as for example, heavy rains. This rapid movement may cause serious damages in houses, structures and people, considering the strong exposition of these vulnerable elements located near the bottom of the slope.