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Slope deformation analysis using terrestrial LiDAR technique for slopes in nuclear power plant sites

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ABSTRACT

The one of the major causes of 2011 Fukushima dai-ichi nuclear disaster was the collapse of off-site power transmission tower induced by the slope failure during the earthquake (東京電力株式会社, 2012). Therefore, the slope stability has become a primary geotechnical issue in the nuclear industry. The long-term monitoring on slopes is important to evaluate the impact of a particular event (e.g., localized torrential rainfalls or earthquake) on slope stability. For the long-term monitoring on slopes, the array system of slope-mounted sensors (e.g., inclinometer, tension-wire, or precipitation gauge) may be the most accurate slope monitoring system. However, slope-mounted sensor systems are cost-ineffective for large slopes. In this study, terrestrial light detection and ranging (LiDAR) system was used to measure the yearly deformation of the testbed slope (a length of 1,700 m, and a height of 80 m) which is located in the nuclear power plant site. A point cloud of the slope was acquired using terrestrial LiDAR system. The point cloud was adjusted using station location provided by global navigation satellite system (GNSS), and vegetation was removed from the point cloud using vegetation filtering technique. Digital elevation models (DEMs) of the slope were generated based on the point cloud. Then, the yearly deformation of the slope was analyzed using periodically obtained data. A slight sediment-scouring which has no impact on the slope stability was identified while no significant deformation was found on the testbed slope in this case study. The analysis result reveals that the terrestrial LiDAR could be a reliable monitoring system for large slopes.

REFERENCES

東京電力株式会社 (2012) 福島第一原子力発電所内外の電気設備の被害状況等に係る記録に関する報告を踏まえた対応について(指示)に対する追加報告について (鉄塔倒壊に関わる福島第一原子力発電所内の盛土の崩壊原因).

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