MISSOURI S&T

CENTER FOR TRANSPORTATION INFRASTRUCTURE AND SAFETY

Acquisition of a Leica ScanStation II LIDAR Unit

by

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16. Abstract

The funding will be used to purchase a LiDAR (Light Detection and Ranging) unit to generate external funding in many diverse areas. The investigators will initially seek funding from NSF, transportation agencies, and emergency management agencies for studies on rock cut raveling, movement of highway embankments, and architectural reconstruction respectively. It will be used in measuring bridge deflection during load tests. The Natural Hazards Mitigation Center will use it for forensic investigations of transportation infrastructure damaged by natural hazards. Further applications will be funded from homeland defense initiatives on blast resistance of bridges and tunnels. The use of LIDAR will be revolutionary in the field of geology, geological, civil, and architectural engineering.

The equipment will be housed in the PI's office at 1006 Kingshighway (It will be used primarily on highway field sites). The equipment will be used by Drs. Maerz, Anderson, and Rogers of Geological Engineering, and Dr. Abdul Salaam of Geology for transportation related research on highway slopes, embankments, and rock cuts. It will also be used by Drs. Maerz and Baur of Civil, Env., and Arch. Engineering, for research on transportation Infrastructure, including bridge deflection load testing.

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Leica ScanStation LiDAR unit

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Executive Summary

Introduction

Acquisition of a Leica ScanStation II LIDAR unit, FINAL REPORT

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A Leica Scan Station II LIDAR (LIght Detection And Ranging) machine was purchased for highway research (Figure 1). This type of LIDAR provides the ability to quickly and accurately generate maps of rock faces and slopes. The device can scan the target area in a matter of minutes and return a digital map that has a stated modeled accuracy to within 2 mm.

Figure 1. LIDAR unit set up in the field.

The device will be used for a number of purposes including measuring the raveling of highway rock cuts and the deflection of bridges under load.

Figure 2 shows an example of a pilot study of a scan and analysis of a rock face conducted in a preliminary study. In this study a scan was completed, and then a construction machine was used to scrape a small amount of rock off the rock face. A subsequent scan was then performed, and the two scans were overlapped in software to identify the areas and volumes of rock removed.

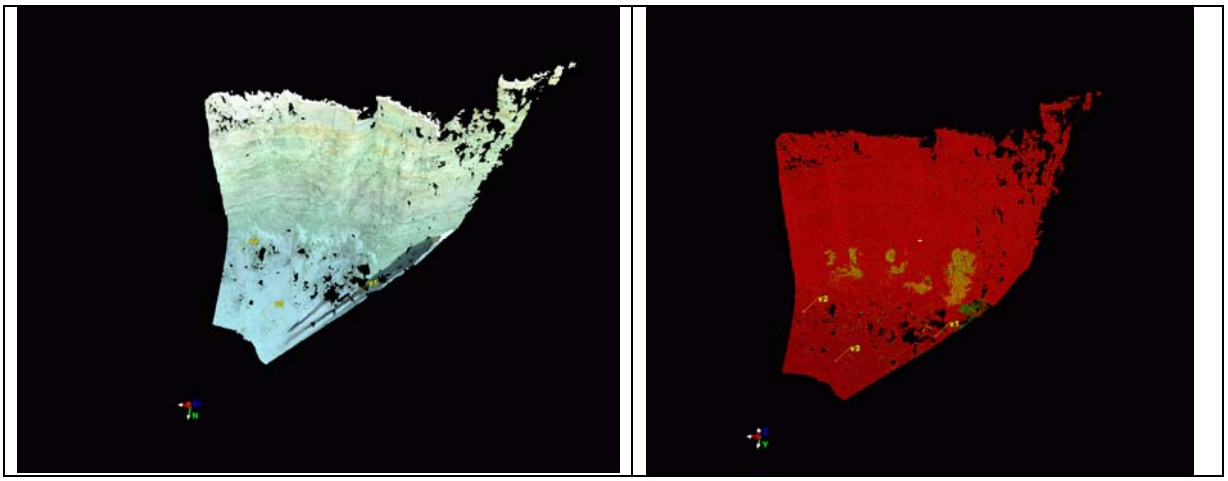

Figure 2: Left: Scan of a rock face. Right: Second scan of rock face (with small sections of rock removed) superimposed over the first scan. Yellow areas show where rock has been removed.

Another pilot study was conducted to determine the sensitivity of the device in measuring the distance to a flat overhead surface. Figure 3 shows a doughnut pattern that was used to measure the distance to the ceiling. When averaging all 5 million z (elevation coordinates), the error between 2 subsequent scans was found to be about 0.5 mm.

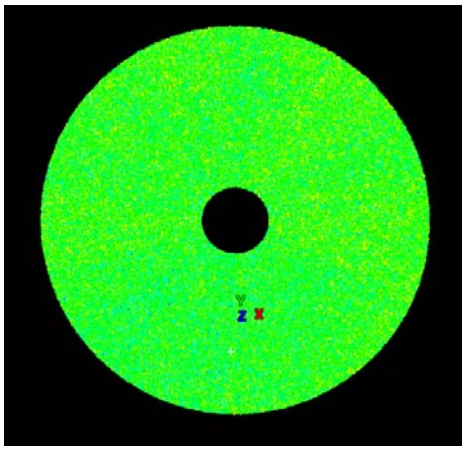

Figure 3. LIDAR Scan of the ceiling of a room, from 85 to 89 degrees, consisting of xxx scanning points