



MISSOURI
S&T

CENTER FOR TRANSPORTATION INFRASTRUCTURE AND SAFETY

Acquisition of a Leica ScanStation II LIDAR Unit

by

Norbert H. Maerz



**NUTC
RE206**

**A National University Transportation Center
at Missouri University of Science & Technology**

Disclaimer

The contents of this report reflect the views of the author(s), who are responsible for the facts and the accuracy of information presented herein. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program and the Center for Infrastructure Engineering Studies UTC program at the University of Missouri - Rolla, in the interest of information exchange. The U.S. Government and Center for Infrastructure Engineering Studies assumes no liability for the contents or use thereof.

Technical Report Documentation Page

1. Report No. NUTC RE 206	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Acquisition of a Leica ScanStation II LIDAR Unit	5. Report Date April 2008		6. Performing Organization Code
	8. Performing Organization Report No. 00017562		
7. Author/s Norbert H. Maerz	9. Performing Organization Name and Address Center for Transportation Infrastructure and Safety/NUTC program Missouri University of Science & Technology 223 Engineering Research Lab Rolla, MO 65409		
12. Sponsoring Organization Name and Address U.S. Department of Transportation Research and Special Programs Administration 400 7 th Street, SW Washington, DC 20590-0001		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. DTRT06-G-0014	
13. Type of Report and Period Covered Final		14. Sponsoring Agency Code	
		15. Supplementary Notes	
<p>16. Abstract</p> <p>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.</p> <p>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.</p>			
17. Key Words Remote sensing, non-destructive testing	18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.		
19. Security Classification (of this report) unclassified	20. Security Classification (of this page) unclassified	21. No. Of Pages 3	22. Price

Leica ScanStation LiDAR unit

Norbert H. Maerz

Executive Summary

Introduction

Acquisition of a Leica ScanStation II LIDAR unit, FINAL REPORT

Norbert H. Maerz, Associate Professor
Missouri S&T
1006 Kingshighway
Rolla, MO 65409-0660
Telephone: 573-341-6714
norbert@mst.edu

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.

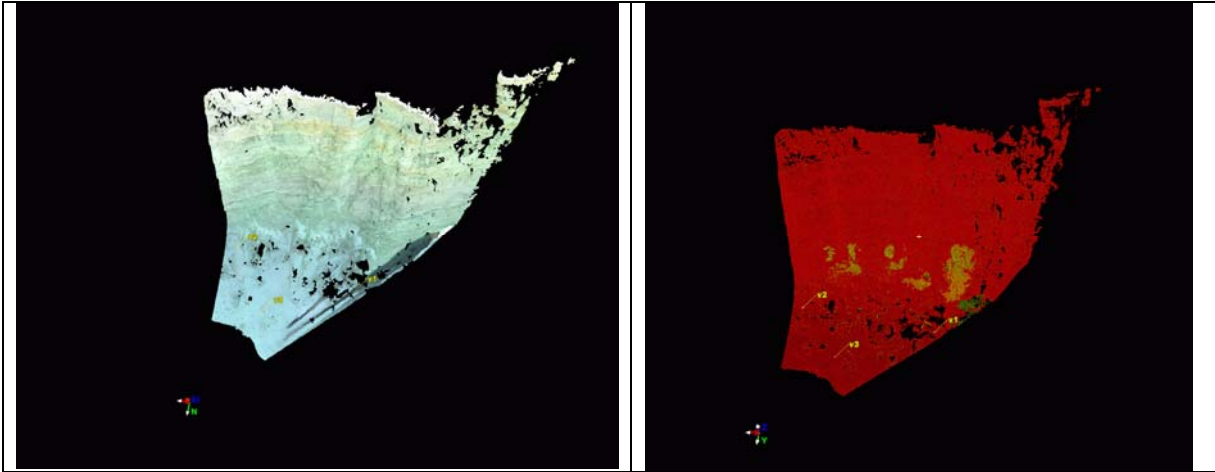


Figure 2: Left: Scan of a rock face. Right: Second scan of rock face (with small sections of rock removed) superimposed over the first scan. Yellow areas show where rock has been removed.

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.

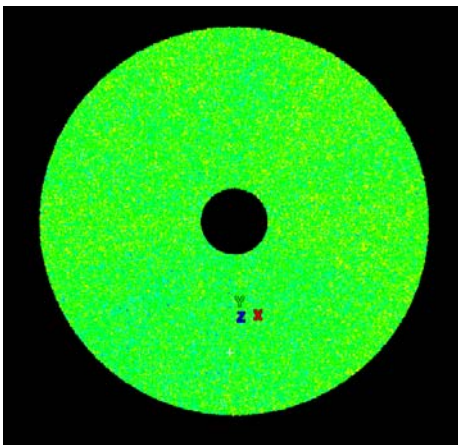


Figure 3. LIDAR Scan of the ceiling of a room, from 85 to 89 degrees, consisting of xxx scanning points