

APPLICATIONS FOR TRIMBLE 3D SCANNERS IN STUDIES OF ACCIDENTS AND CRIMINOLOGY (FORENSICS)

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KEY WORDS

3D scanner, criminology, collapses, virtual anastylose

SUMMARY

Laser surveying in 3D using 3D laser scanners in crime scenes, attacks or accidents, enables obtaining a complete topographic documentation of the location and the objects present, including metric information (3D) and images (2D) (the latter if the scene is lit up or if the survey takes place during the day). These surveys are carried out in a very short space of time, which enables getting traffic circulation back to normal in the case of a road accident or starting repairs in record time. This article presents some of the applications in this field, carried out with Trimble equipment.

1. COLLAPSES AND SUBSIDENCES

On 14th February 2003, the playground of a pre-school in Paris collapsed over the work on a new tunnel. The hole was able to be filled in with concrete within a few days. The scene had been completely scanned within a few hours of the accident. The digital model enabled the whole scene to be precisely documented and used as the basis for in-depth analysis and examination by different experts (geologists, builders and contractors) in order to find out the causes of the collapse.

Trimble Engineering & Construction Group, 5475 Kellenburger Road, Dayton, OH 45424, USA

As all necessary steps for the safety and exploration of the site were already in place, the survey only needed one scanner and one operator. Both went down into safe areas.

This example of collapse can be compared to that of the September 2001 attack in New York. “Ground Zero” was completely scanned by a 3D laser on the ground, combined with an aerial laser survey.

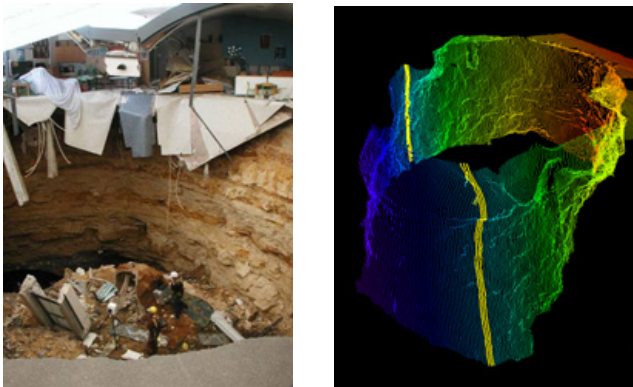


Figure 1: Pictures of the school playground and the point cloud captured with the GS100.

2. AIRCRAFT AND SPACESHIP ACCIDENTS

Another two examples that have shown the usefulness of Trimble laser scanners: the crash of the American space shuttle “Columbia” and the explosion of a drier in a paper manufacturing machine.

NASA and Boeing, the organizations responsible for the maintenance of the space shuttle, scanned all the pieces of the shuttle that were found (about 400), using Trimble laser instruments and totally reconstructed the shuttle using the virtual anastylase

method, in order to analyze the causes of the accident on 1st February 2003.



Figure 2: Trimble S10 scanner in the hangar for rebuilding the American space shuttle “Columbia” and reconstruction from point clouds.



Figure 3: Initial scan of the Columbia shuttle carried out by Boeing in 2000.

In 2000 NASA and Boeing purchased various 3D laser scanning systems from Trimble, which enabled them to obtain an updated and real 3D model of the Columbia shuttle. This initial scan was used for the reconstruction after the accident. The results of this virtual reconstruction were presented at the SPAR2004 conference Houston, Texas, USA in May 2004.

3. INDUSTRIAL ACCIDENTS / RISKS

The case of the explosion of various components in a paper manufacturing machine have shown the efficiency of laser scanners for finding the causes of the accident. The pieces of the two drier rollers, just like those of the space shuttle, were scanned one by one. By virtual reconstruction of the pieces (anastylose) the experts were able to confirm that the explosion had been caused by the collapse of a metal beam in the support structure.

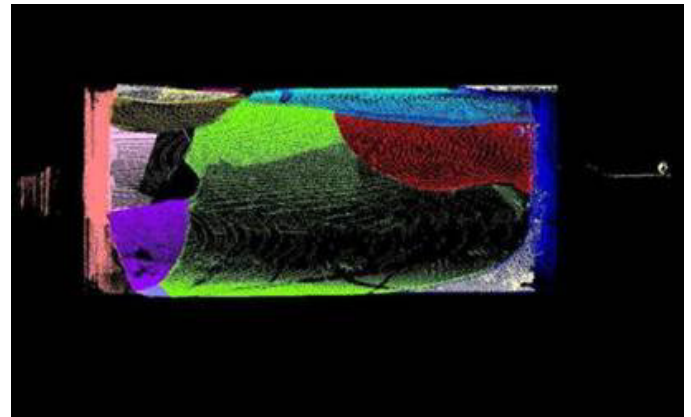
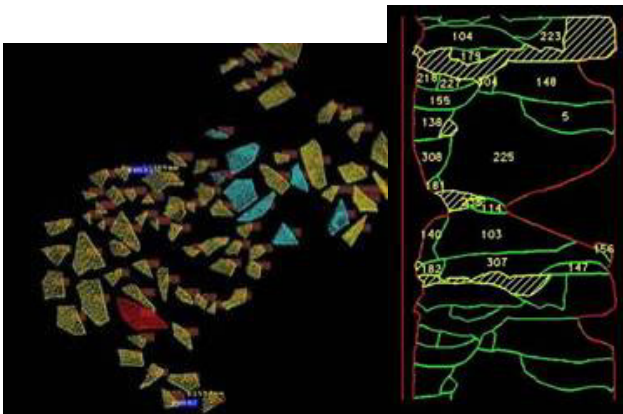


Figure 4: Scan of the pieces of the drier rollers and reconstruction results.

In this case in particular, the conclusions of the study by laser were able to be totally confirmed by means of a traditional examination of the pieces. Nevertheless, while the examination by laser scanner only needed a few hours work on site, the traditional examination involved sending all the pieces in a container by sea to the USA, and the report was delivered several months after the accident.

The study of the craters caused by an industrial explosion can also be done by means of the laser scanner. The virtual mock-ups and simulation models can provide more accurate results in regard to environmental impact in case of accidents.

4. TREMORS AND EARTHQUAKES



Figure 5: Hokkaido, Japan, laser surveys of a road after an earthquake, and the results obtained.

Hokkaido, Japan. September 2003. [1] An earthquake of magnitude 8.3 on the Richter scale causes major material damage and over three hundred injuries. With the aim of re-establishing the railway and road infrastructures as quickly as possible, 3D laser scanning proves to be the most efficient and fastest analysis tool. At the same time, the results obtained enable preparation for the necessary repairs with computer programs, and fine tuning the results of the theoretical simulations in order to compare them with the actual results surveyed in the field. The latter operation can also be used in the verification of

models and digital simulations of crash tests in the motor car industry (the General Motors Group possesses 3D laser instruments for these applications).

5. CRIME SCENES AND TRAFFIC ACCIDENTS

From a simple car accident to the complete survey of a crime scene, the laser scanner brings a virtually complete digital record of the facts at a precise moment. This 3D imprint can be used to confirm or reject the various hypotheses given by the investigators. Proving the guilt or innocence of suspects in court can be made easier by means of these studies in 3D. In case of dispute, the data collected with a 3D laser scanner can provide additional elements for understanding the facts. The Faculty of Medicine at the University of Hanover, Germany [2], uses Trimble 3D laser scanning systems to carry out topographic surveys of car accidents, in order to then analyze what caused them.





Figure 6: Results of laser scanning of a car accident and a crime scene.

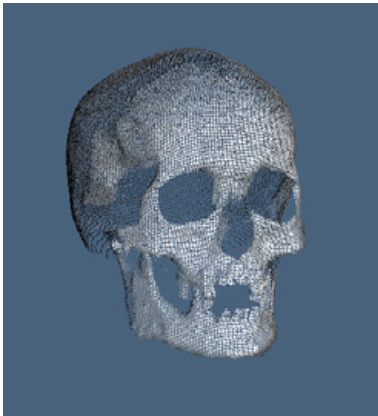


Figure 7: Scanning tests on human remains, Gendarmerie Nationale – Rosny-sous-Bois

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