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The mission of Iowa's LTAP: To foster a safe, efficient, environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

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Laser scanning can improve project efficiency

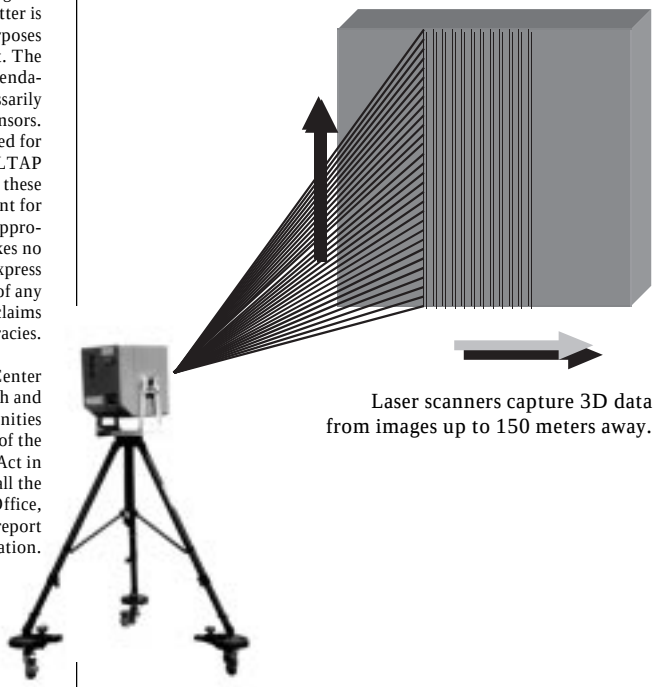
LASER SCANNING is a state-of-the-art technology with the potential for improving the efficiency and cost-effectiveness of many highway and bridge projects. Laser scanning provides a fast and accurate method for gathering three-dimensional (3D) data to use in surveys, design models, and construction.

How laser scanning works

A laser scanner is taken into the field, attached to a laptop computer, and directed toward a structure up to 150 meters (490 feet) away. A laser beam pulses from the scanner toward the structure (see figure below), capturing detailed 3D data at approximately 2,000 data points per second. Captured data are stored in the computer and can be immediately viewed as a 3D "point cloud" image on the screen. This cloud of points is a dimensionally accurate representation of the existing object.

Laser scanner capabilities

Further enhancements, such as "shrink-wrapping" (a process that makes images clearer), can be made using the capabilities of available laser scanning software. Scanned data can also be exported to CAD applications such as AutoCAD and MicroStation. If desired, two-dimensional drawings can be created from the three-dimensional models.



Laser scanners capture 3D data from images up to 150 meters away.

The 3D models generated through laser scanning include extensive detail and allow for fast and accurate measuring. The virtual database that is created can be used to design modifications to an existing structure or to design new structures.

Though a fairly new technology, laser scanning applications are already being used to improve efficiency in many different areas, as illustrated by the examples below.

As-built surveys. When accessibility and safety issues prevent a traditional survey, laser scanning offers an excellent alternative. Laser scanning can be used to perform accurate and efficient as-built surveys and before-and-after surveys. Inaccessible locations, complex arrangements, and hazardous locations can all be easily modeled.

Construction design. Construction design is one of the largest areas for 3D modeling development. Designing construction projects using 3D modeling has been found to have many benefits:

- Coordination issues can be minimized with virtual design and construction.
- 3D modeling provides efficient generation of multiple views.
- The 3D modeling process can generate automated bills of material.
- Data generated through laser scanning and modeling can be efficiently integrated into analysis software.

Transportation applications

There are many benefits to using laser scanning for highway design, including the ability to survey during heavy traffic times without positioning surveyors in the roadway and without closing the road. Laser scanning has been successfully utilized for highway widening projects and for creating as-built drawings of bridges to assist in modifications.

The Pennsylvania Department of Transportation used laser scanning to efficiently generate a 3D rendering of an existing bridge (see figure, top of page 3). This process has the potential to significantly reduce the costs of many highway and bridge rehabilitation projects.

In addition to many other potential transportation applications, laser scanning also provides an

LASER SCANNING . . . continued top of next page

LASER SCANNING . . . continued from previous page

excellent method for rebar tie-wire inspection, assessing potholes, and inspecting roads for rutting.

For more information

For more information contact Associate Professor Edward Jaselskis, Department of Civil and Construction Engineering, Iowa State University, 515-294-0250, ejaselsk@iastate.edu. •

Laser scanned 3D images of existing bridges, like this one in Pennsylvania, could help agencies reduce rehabilitation costs.

DOWN UNDER . . . continued from page 1

making it "very political," according to Dr. Jahren. In the state of Western Australia, all maintenance has been privatized.

Road building basics

Gravel roads. More progressive road agencies build gravel roads with a four percent cross fall that allows them to shed water and resist pothole development. Gravel roads are built in two layers: a strong bottom layer with clean crushed stone to provide strength, and a top layer of crushed stone mixed with clay binder to mitigate dust and corrugation.

Paved roads. Most paved roads in Australia (including a few four-lane expressways) are actually layers of unbound aggregate with a seal coat surface. Superior quality control of the base construction process helps make this method successful. However, differences in weather, vehicle loads, maintenance practices (these can be fragile roads that require immediate maintenance action when problems develop), and user expectations (sometimes these roads do get bumpy as they age) may cause challenges if we attempt to transfer the technology here.

Australians' road use expectations are slightly different from ours.

Cementitious stabilization. Seal coat roads are often rehabilitated through cementitious stabilization. Australia's and New Zealand's practices minimize additive requirements and add quality control efforts in comparison to our regional practice.

For more information

The Minnesota Local Road Research Board funded a report of Dr. Jahren's findings. For a copy, call the Minnesota Department of Transportation's Office of Research Services, 651-282-2274. Ask for report number P2002-01. It is also online: mnroad.dot.state.mn.us/research/. (Click on "Products," then on "Online reports.")

For additional information, contact Dr. Jahren, 515-294-3829, cjahren@iastate.edu. •

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