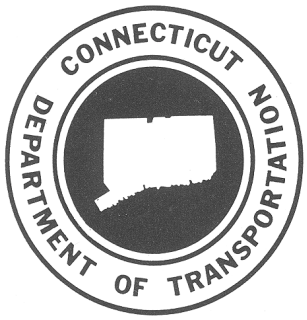
RESEARCH PAYS OFF

Laser Videodisc Technology Meets Changing Operational Demands



Many state transportation organizations are searching for new technologies to provide quick and accurate collection, verification, and analysis of data to fill the void caused by reductions in staff and increases in work load. The Connecticut Department of Transportation has met this challenge by using laser videodisc technology to provide information and data for the department's operations since 1984. Developed in cooperation with the Federal Highway Administration, the technology was introduced to improve the accuracy, efficiency, and safety of data collection in ConnDOT's pavement management system.

Problem

ConnDOT has recently undergone a 20 percent reduction in personnel, although the work load has increased in response to expanding operational requirements, legislative mandates, and public involvement. If required data on the physical characteristics of a roadway are not available in existing files or data bases, one or more individuals are sent to gather the information needed. Manual collection methods typically range from a simple drive-by survey to the dispatch of a survey crew with engineering equipment to record detailed measurements. The costs of manual data collection are high because of labor and travel costs.

Solution

To compensate for staff reductions and increased work loads, ConnDOT has employed its photolog videodisc image system, which contains images of the entire 6300 centerline kilometers (3,900 miles) of state-maintained highway network. Two photolog vans gather photographic images of the pavement and roadside as well as geometric data at 16-meter (0.01-mile) intervals. While filming, sensors located in the van generate an array of data including route number, direction of travel, roadway cross slope, compass reading, date, time, horizontal and vertical curvature, roadway roughness, grade, side friction, and vehicle speed. The images are stored on a laser videodisc that resembles a 305-millimeter- (12-inch-) diameter silver phonograph record. In effect it is a larger version of the compact discs used in home audio systems, personal computers, and commercial photodiscs. All images and related data for the entire state- owned roadway network are contained on 15 videodiscs. These images are a combination of windshield and close-up views of both pavements and appurtenances.

The advantages of the videodisc system are random accessibility, storage density, and durability. In addition, the ability to control the videodisc player with a personal computer enables retrieval of a particular highway photolog image or a series of images in a few seconds. Using high-resolution computer graphics to generate and overlay precisely located grid lines on the photolog image, an operator can easily measure numerous roadway features.

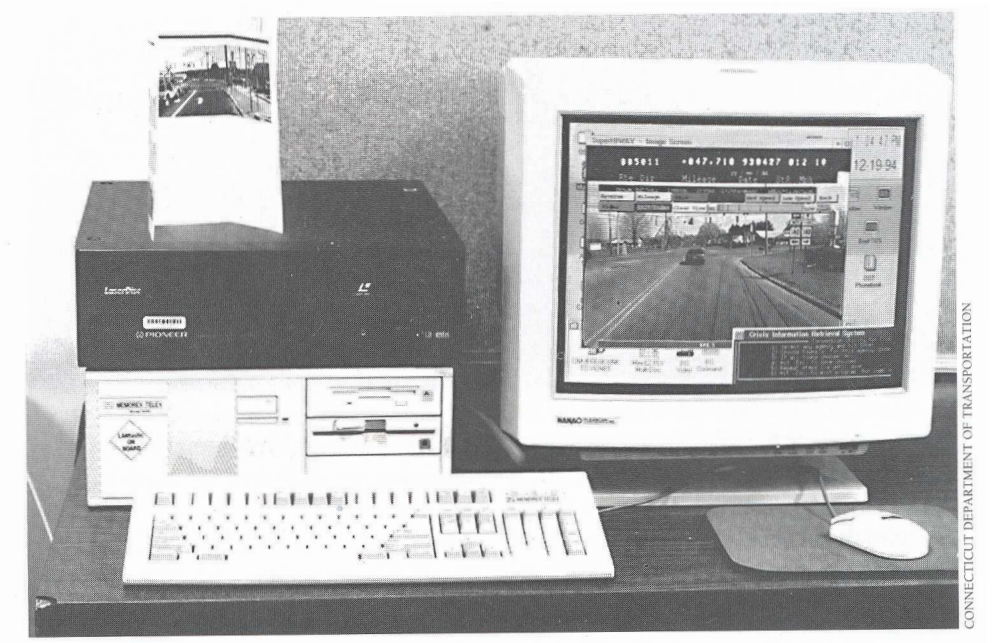
The videodisc system was developed in-house using off-the-shelf components. The process automates simple, low-level, highly repetitive tasks, yet retains operator intervention capability and control at the decision-making level. For example, the retrieval and viewing sequence of photolog images used to evaluate pavement condition is automated, but the actual distress evaluation is left to trained technicians familiar with pavements. The photolog system allows completion of tasks that previously were more difficult to complete manually. For example, gyroscopes mounted in vans can record information used to calculate roadway curve radii and rated speed limits and measure bridge clearances, heights of light poles and signs, lengths of guiderail, and sign offset distances.

Application

Photologging and videodisc production have been performed annually for the state-maintained roadway network for more than 10 years. Pavement rating from videodisc images began in 1987 and has formed the basis for the annual list of ConnDOT paving projects. This automated system has become an integral part of the department's operations.

Use of the photolog system has expanded beyond the pavement management system to address information needs such as roadway inventory, sign/signal inventory, research and special studies, public hearings, court cases, insurance claims, traffic accident studies, geometric studies, design improvements, hazardous-obstacle identification, railroad-crossing inventory, roadway-access determination, bicycle studies, location of roadway appurtenances, utility location, right-of-way review, bridge conditions, pavement-marking surveys, and maintenance. The photolog stations are used for enquiry, measurement, analysis, review, and reporting in the daily operations of many units within ConnDOT. Twenty photolog retrieval stations distributed throughout ConnDOT facilities are used daily by department and Federal Highway Administration employees and the private sector. Private and public sector requests for photolog images from the system each average about 300 per month.

The photolog at ConnDOT is easy to use and widely accepted. A growing approval of and familiarity with this technology has enhanced job performance and satisfaction. Technological and implementation goals must be realistic and flexible enough to change with the needs of the organization. Automation must not be seen as a quick fix to a problem but as a tool to be used and maintained by the organization over a period of time.



Connecticut Department of Transportation photolog laser videodisc workstation.

Benefits

The direct benefits of the photolog videodisc system include reductions in travel expenses and labor costs for various tasks. The results of its use include higher productivity, a safe and comfortable work environment, and the ability to view field conditions from the office. The photolog system has ancillary benefits such as allowing tasks to be "re-engineered." One employee can use photolog images, geometric data, and computer programs to complete in an hour a task that may have taken a two-person field crew a day to accomplish.

With the wealth of pictorial and numeric data available, new problem investigation methods have been developed. For example, instead of evaluating only the current pavement condition when determining paving priorities, pavement distress images and data for several years can be analyzed. FHWA research engineers have used the system extensively to measure sign entrance angles.

Information obtained from the photolog system has eliminated the need for 80 percent of field trips. When compared with traditional field trips, photolog use generates an estimated $1 million savings annually in travel and labor costs and more than 200,000 miles of reduced vehicle travel. This figure does not include the additional savings of safety and convenience that the photolog system offers. Recent efforts to implement a new inventory system for the state's 170,000 highway signs established that the cost of the photolog system would be less than $0.5 million compared with the inventory system, which would cost $1.3 million if traditional data-collection methods were used.

The number of photolog stations is expected to increase as additional units within ConnDOT and the public and private sectors recognize the capabilities of the system. Moreover the rapid evolution in computer-based imaging technologies is underscored in the significant cost reduction of a retrieval station (i.e., $30,000 during the period 1984-1993 to as little as $4,000 in 1994 to retrofit a desktop PC). The expansion in the number of photolog stations is consistent with the philosophy under which the technology was developed: to share information with as many users as possible.

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Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 (telephone 202-334-2952).