RESEARCH PAYS OFF

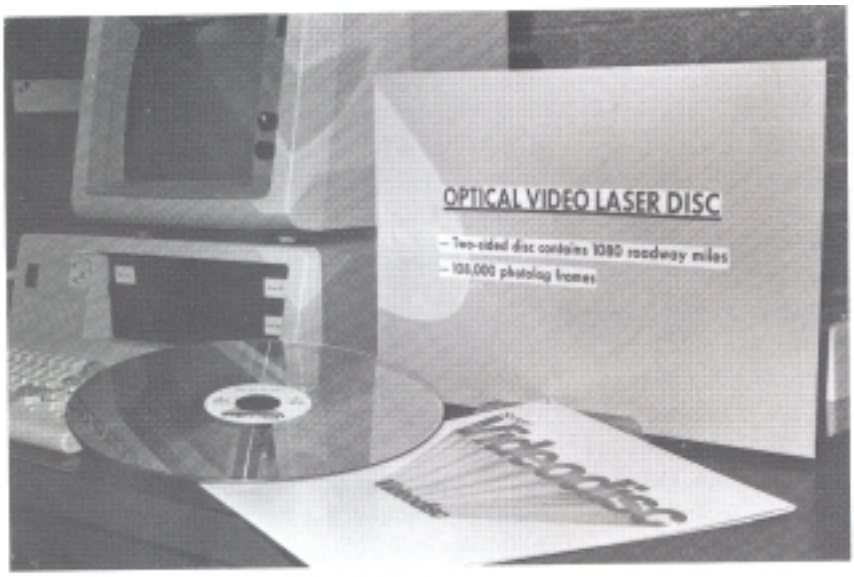


FIGURE 1 Photolog laser videodisc.

ConnDOT Uses Laser Videodiscs in Photologging

Photologging, introduced in the mid-1960s, is now considered an effective tool for the administration of safety, planning, maintenance, pavement management, and other highway programs by many transit agencies. Some 42 states photolog highway networks, as do numerous U.S. counties, 4 Canadian provinces, and several foreign countries. Most highway administrators support photologging because the procedure reduces the need for many field trips by agency personnel. In Connecticut, records reveal that each year the viewing of photolog film by agency personnel eliminates the need for hundreds of field trips; in 1984 alone, the state saved $250,000 because of the use of photologging.

Connecticut's 4,000-mile state highway system and 600-mile railway system are photologged bidirectionally at 0.01-mile intervals, which produces 920,000 35-mm still frames of color film. Positive prints are made on 35-mm strip film and edited onto small reels for viewing on 35-mm strip film motion-still analyzers. Each photolog library contains 660 small film reels, a printed index, and an analyzer.

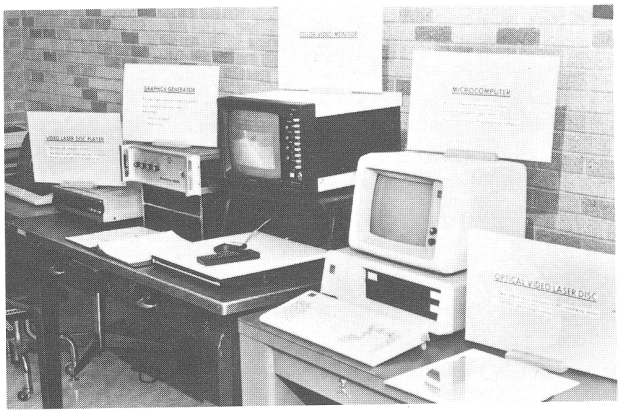
Problem

Connecticut Department of Transportation engineers sought to utilize the photolog to inspect pavements. Existing manual pavement-distress survey methods involve undesirable trade-offs between survey precision and cost of data collection and analysis. Manual methods in use today range from high-speed windshield surveys to walkover surveys involving detailed measurements.

In early 1983, ConnDOT undertook a project to develop a pavement management system. Three types of pavement-condition data were identified as required input: roughness, distress, and safety. According to ConnDOT engineers, the photolog-image quality appeared to be adequate to support a network-level visual distress rating even though it was recognized that others had tried this procedure unsuccessfully.

During the study, the photolog film proved to be cumbersome to work with.

FIGURE 2 Microcomputer-controlled viewing system with high-resolution graphics capability.



The strip film was easily scratched and torn during projector loading, operation, unloading, and normal handling. Because film is a linear-access record and Connecticut's highway photolog consists of 9.25 miles of strip film, the visual rating was slow and cumbersome. Together these limitations appeared to doom the photolog visual-rating project.

Solution

The inherent limitations of photolog film and the film-viewing systems led the project's principal investigator, James M. Sime, to consider if optical laser videodisc technology could be used for photolog-image storage, retrieval, and viewing. John H. Hudson, photolog supervisor, joined Sime to investigate the technical capabilities of videodiscs and the technical requirements of laser videodisc production. The Federal Highway Administration facilitated evaluation of this innovative idea by supporting development of a demonstration photolog videodisc.

A laser videodisc is a "write-once" (image cannot be erased) storage medium that resembles a 12-inch-diameter silvery phonograph record (Figure 1). Each side of the videodisc can contain up to 54,000 still-frame pictures, the equivalent of 540 miles of unidirectional roadway photolog. To produce a disc, images are digitized and then recorded as dot- and dashlike pits onto the reflective surface of the videodisc with a high-energy laser beam. Videodisc players use a low-energy laser to read the video information from the disc. Pictures (moving and still), alphanumerics, graphics, and sound can be stored at known frame-coded addresses, which may be retrieved via players with a random-access frame-search capability.

Today's laser videodisc players read one side of the videodisc at a time, and are capable of random-access frame searches to any of the 54,000 photolog frames in less than 3 seconds.

Application

A total of 540 miles of selected highway routes were photologged in order to produce a demonstration videodisc. Hudson and Sime learned that videodisc premastering and production equipment varies considerably in capability, as do industry techniques and methods. Because ConnDOT's pavement-inspection requirements demanded maximum image resolution, an X-Y zoom technique was utilized in trials to record close-ups of the pavement portion of the images, which resulted in images rich in detail and considered satisfactory for the visual rating of pavement distress.

The entire highway photolog of Connecticut, both full-format and close-ups, can be sorted on 15 videodiscs. Each disc contains the equivalent of 270 miles of full-frame photolog, with the corresponding 270 miles of pavement close-ups on side one and another 270 miles of highway photolog on side two. The use of a personal computer to control the videodisc player enables ConnDOT engineers to retrieve particular highway-photolog locations or series of photolog frames quickly and easily (Figure 2). In addition, ConnDOT is using a device that generates high-resolution computer graphics (768 by 484 pixels) and overlays them onto the photolog video image. Highly detailed grids have been created for use in extracting roadway measurements from the photolog videodisc.

Benefits

Photolog on laser videodisc has several advantages over film, including denser information storage, extremely fast random access, and greater physical durability. Image quality is superior to that of videologging. Another important capability sets videodisc apart from other approaches: close-ups of the pavement portion of each photolog image can be recorded from the photolog film source.

ConnDOT personnel have recommended that additional photolog libraries be located throughout the state in various facilities. Frequent users of the existing photolog film libraries have been given demonstrations of the videodisc viewing system. To date, operations personnel from traffic, maintenance, inventory, design, and research units have voiced mutual support for the videodisc approach. It is apparent that the enhanced capabilities of computerized videodisc viewing systems will significantly increase labor savings, reduce vehicle usage, and result in fuel savings.

It is estimated that 10 videodisc libraries could be provided for the cost of 6 film libraries. The cost and procedures for photolog data collection are the same for each storage, retrieval, and viewing system. It is estimated that with the establishment of 10 laser videodisc libraries, the resultant reduction in the number of field trips would lead to a savings of $4 million over 5 years—twice the savings resulting from an equivalent expenditure on 6 film libraries. The ease of use and system programmability should enable additional varied and imaginative uses, which should result in even greater savings to the state.

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