

Technology

Roads Bridges Transit

Iowa State University
Extension to Communities

Iowa Transportation Center

News

August 1991

Study examines merit of P.E.'s

By ITC staff writers

An Iowa State University researcher is beginning an Iowa Department of Transportation and Midwest Transportation Center project that will examine the county engineer profession.

The project revolves around the merit of having professional, registered engineers in charge of county secondary road departments, according to the project's principal investigator, Kathleen Waggoner.

"The level of expertise these professionals bring to the job is presumably warranted by the value they provide the counties through more efficiently managed road departments, and reduced legal liability through safer and better operation of the roadways," Waggoner said.

A related issue is the need to attract responsible, motivated, and committed young professionals to pursue county engineering positions. A large percentage of county engineers are reaching retirement age at a time when a shrinking employment pool may jeopardize the quality of secondary road systems, not only in Iowa, but nationwide.



Principal Investigator Kathleen Waggoner (seated) and graduate students Winnifred Neely and Federico Irrang.

Inside pages

- 2 Legislators make more money available for UST cleanup.
- 3 Microtechnology discusses how laser printers work.

"Many states do not require professional engineers be in charge of secondary road activities. These states may require technical persons in charge to have particular training for the position. This training helps fill some of the gaps in expertise which

exist due to the lack of engineering education. Experts argue that new strategies need to be developed to assure that the level of services provided to counties remains high," Waggoner said.

"As we move toward the twenty-first century, in an era of declining resources, it is likely that professional staff members in charge of secondary roads will find themselves working with less flexible budgets for the construction and maintenance of roads and bridges. The challenges presented to them will demand greater expertise in prioritizing resource allocations for the rehabilitation and maintenance of the network of roads for which they are responsible."

Engineers are also likely to be interacting even more with various citizen's groups and public/planning agencies, according to Waggoner.

"The county engineer's or equivalent's office currently demands far more than technical skills alone," she said. "A broad scope of organizational knowledge and engineering expertise will intensify the time-consuming, interrelated ser-

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State increases UST cleanup fund

An amendment to the 1989 Leaking Underground Storage Tank Act makes more funds available to help local government agencies and small businesses pay for cleaning up and replacing leaking underground storage tanks.

The amendment, Senate File 363, helps underground storage tank (UST) owners by increasing financial assistance, prioritizing cleanups, and providing property transfer insurance. It was one of a handful of bills and amendments having some affect on city and county street and road agencies.

An increase in the diminution fee is raising the funds needed to finance the amendment. The amendment increased the fee to one cent per gallon. It will raise an additional \$3.3 million for a total slightly over \$15 million per year. Previously, a cap limited the funds raised by the diminution fee to \$12 million per year.

The additional money will help UST owners comply with EPA UST regulations. The original bill underestimated the number of leaking tanks in Iowa and the effect cleanup and replacing USTs would have on small business owners. Leaks were discovered in approximately 80 percent of

the tanks that were tested. Small gas stations — especially those in rural areas — found that the cost of cleaning up and replacing tanks was forcing them out of business.

The amendment calls for the Remedial Fund set up by the state to pay a larger share of the costs. The Remedial Fund now pays 100 percent of a tank owner's cleanup report up to \$20,000. The Fund will pay 82 percent of the corrective action costs which are \$80,000 or less and 65 percent if the costs are more than \$80,000. The owner pays the first \$5,000 of any corrective action cost.

The amendment also considers secondary containment systems, a requirement for tanks that are replaced or upgraded, as corrective action. The Remedial Action Fund will pay up to \$10,000 for any one site.

Property transfer insurance and a system to prioritize tank cleanups were also implemented by the amendment. Property transfer insurance purchased by a property owner will cover cleanup costs that may be mandated by future government regulations. Leaking tanks are prioritized based on the extent of the public health, safety, and environmental risks posed from actual or potential

contamination of groundwater sources used for private or public drinking water.

A site may be ranked as "high risk," which requires immediate cleanup; "low risk" sites, and "no action required" sites. Low risk sites would be monitored and if after 12 years no significant increase in contamination is found, then the site will be reclassified as a no action required site.

These changes came during a review by a Leaking Underground Storage Tank Task Force established early in the 1991 legislative session. Its purpose was to help make the original act more workable for Iowa's small businesses. A public hearing sponsored by the House Committee on Energy and Environmental Protection was held on March 5. Over 120 people attended the hearing, with the majority of testifiers stressing the importance of prioritizing leak cleanup, streamlining the process by reducing paperwork, and asking legislators to provide more funds to help cleanup contaminated sites.

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The opinions, findings, or recommendations expressed here are those of the Iowa Transportation Center and do not necessarily reflect the views of the Federal Highway Administration or the Iowa Department of Transportation.



IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

ITC celebrates 50th issue and more

This is the 50th issue of *Technology News* to be published by the Iowa Transportation Center. The first issue was published in 1984 and the ITC is proud to offer *Technology News* as one of its many services.

The ITC, of course, provides a variety of other services. Many *Technology News* readers attend ITC courses, use the ITC library managed by John Moody, and take advantage of special in-house training programs like those conducted by Safety Circuit Rider Ed Bigelow.

This 50th issue of *Technology News* is special for another reason.

It is the first issue to use computer-scanned photographs. Before this issue, photos were prepared for publication in the traditional manner of being transformed into halftone prints by the printer. This would often take several days. The scanner allows us to save time by making halftone prints on the computer.

One of the newsletters' features, For More Information, provides information on some of the publications and videotapes available in the ITC library. Recent additions to the ITC library push the number of videotapes to 230, all relating to transportation topics. The videotapes, several slide presentations, and over 1,000

publications make the ITC library one of the best resources available for local street and highway agencies.

Some of the materials are well-suited for small group or individualized

amount of fuel. As a result of that experience, Elahi helped several cities comply with a state law requiring traffic signal coordination.

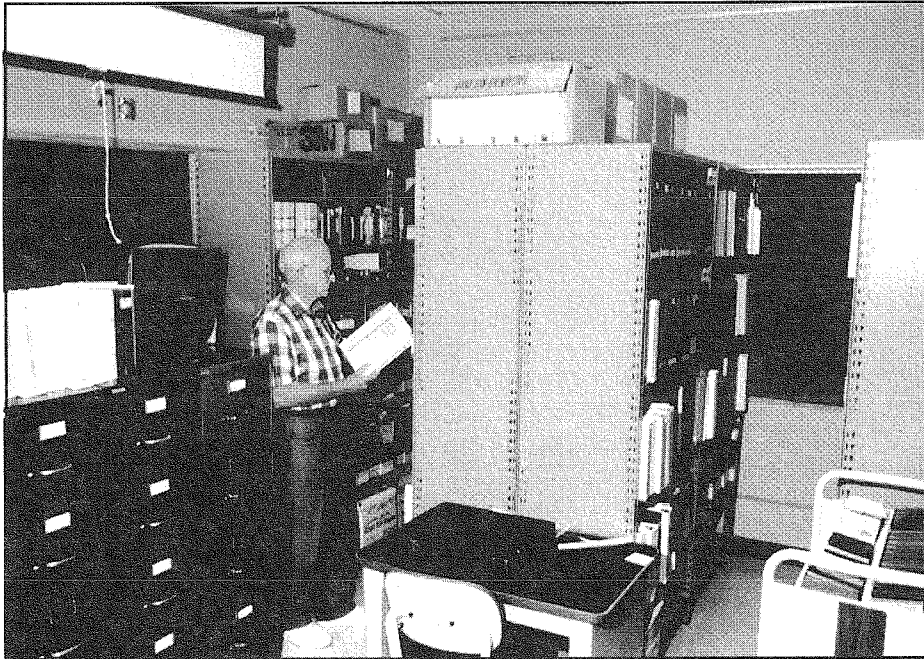
His current project involves revising the Iowa Department of Transportation's "Managing Highway Maintenance" instruction guides.

The ITC's Motor Grader Operator program is well into its third summer. By the end of this year's sessions, 79 counties will have sent operators to the course. To date, 841 operators, foremen, and engineers have participated in

the course; by the end of this year that total will be 993.

Like the Motor Grader Operator Program, the Safety Circuit Rider Program takes safety information directly to both counties and cities. Many city and counties have requested the Accident Location and Analysis Program. This program explains how the accident location report furnished by the Iowa Department of Transportation may be used to locate high accident sites. Once these sites are identified, accidents may be reduced by taking effective corrective action.

For more information about the ITC, please phone 515/294-5642.



ITC Program Coordinator John Moody finds a place in the ITC's library for a new publication.

training. Many of the library's publications may be kept and some videotapes copied. All materials are available by calling John Moody at 515/294-9481. Moody will provide a list of videotapes, publications, and training materials on request.

Although he is the most recent full-time employee to join the ITC staff, Mohammed Elahi has been with the center for almost three years. He was a research associate while completing a Masters Degree at Iowa State University. During that time, he worked on the Traffic Signal Retiming project that determined coordinated traffic signals could in some cases save a significant

Looking inside a laser printer

Have you ever wondered what goes on inside your laser printer? This article tries to answer the question of what makes your laser printer work?

There are three necessary mechanisms of a laser printer. The first one is a marking engine, which is mechanical, and the second one is the controller. It is actually a separate computer. A paper transport system, functioning just as its name implies, completes the printer.

Laser Marking Engine

The engine has two parts; one is the photosensitive drum upon which the image is first electronically etched or "marked;" and the second part is a laser beam system, guided by the controller, which exposes the surface of the drum. The basic concepts of forming an image on a drum which are later transferred to paper were derived from the Xerox office copier.

Cleaning The drum is an aluminum cylinder, the width of a printed page. Its diameter is small, compared to the length of a page because the surface is continuously re-used during printing. The drum is covered with a photoconductive selenium coating. The coating will be a conductor if exposed to light and an insulator in the dark. It is necessary to first clean the portion of the drum to be marked by rotating it past a "quenching lamp." The lamp exposes the surface evenly, effectively erasing any previous image on the drum. Leftover toner deposits are mechanically scraped off as the drum rotates past a cleaning unit.

Charging Next, the now-clean surface, sealed in its dark compartment,

Microtechnology

By Clyde S. Walter
Associate Professor

rotates past a parallel wire through which a small, high-voltage current is flowing. The drum picks up a negative charge due to the corona effect. Since the surface is in the dark and thus is not conductive, the charge does not flow; it is static.

Writing The laser beam moves across the drum by moving, synchronized mirrors. When the point of light strikes the drum, the electrical charge changes as the coating material becomes conductive. The beam will rapidly move on to the next points on the drum and they, too, will be pulsed to either change the conductivity, hence the charge, or not change, until a mirror image of all information has been "written" on the drum, in a series of closely spaced dots. One standard spacing is 300 dots per inch (dpi). The resolution provided by dots that are 1/300 of an inch across provides good quality print although images will not be as sharp as photo typesetters which have 1200 dpi resolution.

Developing The image is then developed on the drum by brushing on electrically charged toner (the carbonized printing medium). The toner will be attracted to or repelled from each point on the drum, depending on the charge at each point. At this time, a mirror image of the printed output would be visible on the drum.

Paper feed Now the critical component becomes the paper feed which must physically propel a sheet of paper into the printer, apply a secondary corona charge to the paper, and pass it over the rotating drum where the toner will be transferred (because of the difference in charge) from the drum to the paper. After the image is transferred it is fused to the paper by the high temperature of a heat lamp and pressure from the rollers.

Variations The system described is called "write-black," with the laser beam erasing the charge where black print is to appear. A variation used by Ricoh is the "write-white" system, with the laser beam exposing the portions which will remain white on the paper as the toner will be given a charge opposite to that of the "write-black" system. Debate continues on which provides sharper resolution, especially on small images. The critical differences may be in the font software.

Engine Control

Computer output to the printer becomes laser pulses after passing through a Raster Image Processor (RIP) in the printer. (This term is similar to that used to describe the forming of a television picture from a set of lines — a raster — followed by a controlled or modulated beam of electrons which strikes the fluorescent surface of the picture tube.) The RIP transfers the printer's input signal into a binary array (consisting of ones and zeros), called a page bit map, and stores it in its random access memory. About one megabyte is required per page stored.

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Engineer research project continued from page 1

vices that already demand a blend of sophisticated engineering and administrative skills from these professionals. As these responsibilities become more intricately related, county engineers or their equivalents are also likely to become increasingly involved in making recommendations to their policy boards within their respective counties.”

The first phase of the project is an effort to assess the contributions that county engineers and their equivalents make. Eight states — Iowa, Minnesota, Nebraska, Oklahoma, Missouri, Kansas, Washington, and Ohio — will participate in that effort.

The broad range of county engineers and their equivalents will provide a representative sample of the professionals who are in charge of maintaining high-quality road networks. These professionals range in title and status from Ohio, with its elected county engineers, to Missouri where nearly all roads are under state or township jurisdiction, to Iowa, which is one of several states whose statutory regulations require their county engineers be registered professional engineers.

Panels of experts from each of the participating states are being assembled to work with Waggoner to develop indicators designed to assess the effectiveness of decisions

made regarding both engineering decisions and the more administrative/supervisory/public relations tasks that county engineers or their equivalents perform.

Survey questionnaires, follow-up telephone calls, and face-to-face interviews will be used to gather information from those in charge of secondary road networks and from their policy boards within each of the states. This will be done in order to identify tasks, objectives, responsibilities, and effectiveness indicators associated with the decision process. Because not all states have statutory requirements mandating county engineers, it is expected that contrasts as well as comparisons can be drawn with respect to the effectiveness of these persons.

Drawing on the data analyzed from phase one, the second phase of the project will focus on the development of new strategies designed to attract students into county engineer positions. This is important in order to assure qualified persons will fill the void left by their retiring predecessors.

The problem of a shrinking employment pool is becoming an increasingly critical issue. Factors that discourage as well as encourage students from considering county engineering as a career will be documented and evaluated. Working

carefully with the panel of experts, proposed solutions and new strategies will be identified and explored. It is expected that this study may well be able to provide new and perhaps critical insights into the role played by county engineers and their equivalents regarding their value to the public.

The results of the project will be generated in reports to be disseminated to all interested parties. Recommendations will be offered in the final report generated by the project. Workshops and seminars will be held in order to provide counties with insights, strategies, and proposed solutions to the “supply problem” presented by retirements and the difficulty of attracting replacements to county engineer positions.

Waggoner is a sociologist and holds a law degree. She is being assisted by two graduate students, Winifred Neely, a Sociology major with a minor in Transportation Planning, and Federico Irrgang, a Civil and Construction Engineering major with an emphasis on Transportation Engineering and Transportation Planning.

If you would like additional information on this project or would be interested in providing insights into it, please call Waggoner at 515/ 294-2872.

Laser printers continued from page 4

Control of the RIP is provided within printers by a page description language (PDL) such as PostScript. The PDL allows selection of fonts and graphics capabilities to be applied to several computer output formats.

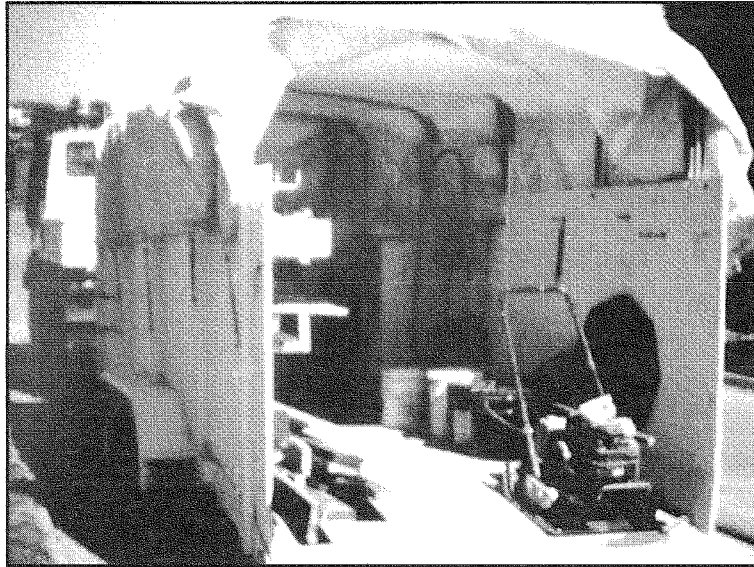
The page bit map is finally sent to the laser which has the relatively simple task of turning on or off, according to the ones and zeros, to provide the required points of light. While the laser remains stationary, the pulsing

light beam is scanned across segments of the drum by rotating mirrors. After each page is sent, the RAM is cleared to receive the next page bit map.

Tips From The Field

Repair trailer keeps tools in reach

The City of West Des Moines concrete crew is kept busy during the summer months maintaining the concrete in the city. Often, a needed tool or piece of equipment would be forgotten or in use at another repair site. So concrete crew chief Jim Brown designed a trailer so that all the tools and equipment would be easy to keep with the crew.



The photo shows how most of the crew's equipment fits inside the trailer. A vibratory

Dedicating a trailer for all the tools necessary to repair concrete keeps everything in one place and readily available when needed.

compactor, forms, curing compounds, and small hand tools all have their places inside the trailer. The trailer ensures that the crew has everything it needs on hand at the job site.

Not visible in the picture is a generator mounted in front of the trailer.

For more information contact Willard Wray, Clive Public Works Director, 8505 Harbach Blvd., Clive, Iowa, 50053. The phone number is 515/223-6230.

UST act provides more funds continued from page 2

Senate File 508 adds a number of sections to the Iowa code relating to energy efficiencies. It increases the number of agencies that may get financial assistance to adopt conservation measures. It also sets energy efficiency standards for certain products and establishes a number of programs to help improve energy efficiency.

Two sections of SF 508 may be of interest to local agencies. Section 14 directs the DOT to promote both an energy efficient public transit system and a rural bus system. It also directs the DOT to develop and implement a bus system subsidization program.

The first section of SF 508 deals with using alternative fuels. Effective July 1, 1992, five percent of all new passenger vehicles and light pickup trucks purchased by the state vehicle dispatcher will have to be equipped with engines that burn alternative fuels. Those fuels could include 85 percent ethanol, compressed natural gas, propane, solar energy, or electricity. The number of alternative-fueled vehicles will increase in 1994 as the percentage is raised to 10 percent. Law enforcement vehicles, off-road maintenance vehicles, and work vehicles used to pull loaded trailers are exempt.

Other bills passed include senate files 97 and 337. SF97 makes the unauthorized possession of a traffic control device a serious, instead of a simple, misdemeanor. It also makes it possible to require a person convicted of interference with a stop or yield sign to perform community service as well as making restitution.

Senate File 337 raises to \$50,000 the amount which must be publicly advertised and bid on road and bridge construction work. It also raises from \$20,000 to \$50,000 the amount for road, bridge, or culvert construction which must first be reviewed by the DOT.

For More Information

The videotapes and publications listed in this column are available on a loan basis by contacting John H. Moody, Iowa State University, Iowa Transportation Center, 194 Town Engineering, Ames, Iowa 50011 or by calling 515/294-9481 Monday, Wednesday, and Friday mornings.

15-page booklet reports on the evaluation of the application of asphalt-rubber in cold climates to dispel the misconception that asphalt rubber works only in hot, dry climates. The report includes a number of photographs to illustrate findings that were made. **Request #726**

update for volume I-6 of the previously published NACE Action Guide Volume I-6, which deals with the National Bridge Inspection Program, Bridge Inventory, Federal and State Bridge Funding, the County Liability for Bridges, and many other details relating to bridges and bridge inspection. **Request #730**

Evaluation of Asphalt Rubber Overlay of Old Concrete, Sterling Massachusetts This is an 18-page booklet by Paul Constantino, Michael P.A. Abraham, and Donald Murray of the Massachusetts Department of Public Works. It gives an account and provides photographs related to a four-mile project on Route 12 near Sterling, MA. The project was divided into eight sections, five of which were devoted to the trial of methods professed to stop or retard reflective cracking with the least amount of traffic tie-ups and delays to the traveling public. Special note is made of the fact that the area involved is subject to temperatures as low as -19 degrees F. and as high as 96 degree F. **Request #725**

Bus Fleet Management Techniques Guide This 310-page manual prepared by Tom Maze, Allen R. Cook, and Utpal Dutta provides transit maintenance managers with methods they can use to derive information for maintenance planning and fleet management. This book contains easy to follow examples derived from actual transit system maintenance records. All techniques can be done using inexpensive scientific calculators. A set of 19 worksheets is provided to facilitate the computations. Some chapters have study questions to further explain the methodologies. Available to keep as long as supplies last. **Request #631**

Heavy Equipment Operation (10-videotape series)
Part 1 Rotary Mower and Tractor Operation, two videotapes The first videotape covers pre-operation inspection of tractor and rotary mowers, including safety devices. The second videotape covers rotary mower techniques. **Running time first tape 14:30 Request #32A-1 Running time second tape 14:30 Request #32A-2**
Part 2 Dump Truck Operation, two videotapes The first videotape covers the operation of dump truck and particular maintenance techniques to be used in order to get the best service. The second videotape covers important basic maneuvers (braking, turning, and backing), dump body operation and shutdown. **Running time first tape 16:00 Request #32B-1 Running**

Cold Climate Condition Survey of Asphalt Rubber Membranes This

NACE - Action Guide Volume I-6, Administration of Bridge Inspection (1990) This is a 38-page

Publication order form

To obtain the materials listed from the ITC, return this form to the Iowa Transportation Center, Iowa State University, Extension to Communities, 194 Town Engineering, Ames, IA, 50011.

	Title	Index No.	No. of Copies
Name _____	_____	_____	_____
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Please send a complete listing of all publications from your office.

Please send a complete listing of all audio visual materials available.

Conference Calendar

Introduction to Personal Computers August 21, Iowa State University This is a course designed to familiarize beginning computer users with the PC-DOS system. Class participants will work through exercises on a computer. Call Connie Middleton at 515/294-6223.

Introduction to Lotus 123™ August 22, Iowa State University This is a course designed to familiarize beginning computer users with the spreadsheet program, Lotus 123™. Class participants will work through exercises on a computer. Call Connie Middleton at 515/294-6223.

Road Surface Management September 17 Council Bluffs This course is for individuals involved in project selection, programming, and budgeting. Each participant will gain a basic understanding of road surface management concepts. Contact Janet Gardner at 515/294-5366.

Elderly Mobility: Roadways to the Future September 26-27, Kansas City, Missouri, Airport Hilton The declining driving skills of the elderly present a particularly acute predicament for the Midwest. This conference will discuss many issues related to problems associated with elderly mobility. Call 515/294-4817 to register .

Management for Street and Road Maintenance Managers October 1, Calmar; October 3, Davenport Call Jo Sedore 515/294-4817.

Traffic Safety - Using Your New Roadside Design Guide October 10, Cedar Rapids, Sheraton Hotel This workshop covers the 1988 AASHTO "Roadside Design Guide" and its role in roadside safety. This course is specifically designed for local governmental highway managers and engineers. Call 515/294-6229 to register for the workshop and 515/294-6384 for

workshop content information.

Garage Waste Management October 15, Ankeny; October 17, Cedar Rapids This workshop explains new environmental regulations and how they affect local government maintenance shops. It also illustrates practical ways to reduce waste volume and lists resources available for recycling or disposing of hazardous wastes. Call BarBara Holden at 515/294-3781 for more information.

Missouri Valley Section of I.T.E. and Oklahoma Traffic Engineering Association Combined Meeting October 23-25, Oklahoma City, Oklahoma For registration information call Neal Chambers or Jacques Mabry at 405/521-2865.

And justice for all
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