Technology News
Roads Bridges Transit —
Iowa State University
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Local Transportation Information Center
January 1990

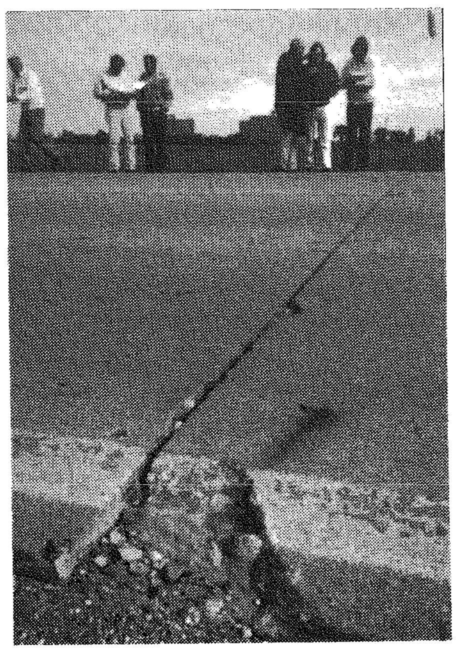
Carroll adopts Center's PMS system

A pavement management system (PMS) software program developed by Iowa State University is helping the city of Carroll modernize street maintenance management.

Jim Cable, the director of extension services for Civil and Construction Engineering, and Omar Smadi developed the Iowa State Pavement Management System. It is based on a similar computer PMS written by the Pennsylvania Department of Transportation, STAMPP. Cities and counties can make better pavement management decisions using the software, but it is not meant to compete with high-end computer PMS or the need to seek the advice of pavement management consultants when necessary.

The program uses only the basics of pavement management. The Local Transportation Information Center's role is to help train city and county staff members to perform basic pavement management functions themselves.

The Center makes the software program available to cities and counties that send staff members to a one and one-half day training workshop, "Local Road and Street Managment." The Center also will help Iowa local agencies install, take the initial road condition survey, and make initial runs on a cost reimbursable basis. The software is based on the popular spreadsheet program, Lotus 123tm, (see the July 1989 issue of Technology News for more information.) It runs on PC compatible microcomputers and requires Lotus 123tm software.



Jim Cable (third from right) answers questions during a pavement management class.

"We chose ISU's PMS because it appeared simple and we're told it will be well supported," Carroll Director of Public Works Randy Krauel said. "It's local and it looked as if it would include everything we need to make decisions in our pavement management."

The Center hired Richard Lane, a retired Iowa Department of Transportation construction inspector, to do the initial pavement inventory. Lane is training two of Krauel's maintenance employees to do the city's inventory in the future. Center staff available to do the inventory is one of its best selling points, according to Krauel.

"The big hurdle for me is getting the initial inventory done," Krauel said. "We just don't have the staff or the time to do it ourselves."

During the pavement inventory, a value is assigned to each type of distress or defect found on a particular road segment. These values are then input into the software program. The operator can then run the

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Inside pages

Early tracks laid by hand and by horse

In 1853, the first railroad construction west of the Mississippi was in Davenport by the Mississippi and Missouri Railroad. Construction in those days was by hand labor with ties delivered by horse-drawn wagons after the rails had arrived on flat cars. With a gang of 75 men, 7,000 feet of track was a good day's work at a cost of about $125 per mile.

Past Roads

By Dr. Stanley Ring
Professor Emeritus of
Civil and Construction Engineering

Many of Iowa's early railroads utilized track-laying machines and large crews of men to lay 2.5 miles of track per day.

Later it was found that "track-laying machines" could be utilized to produce more miles per day. In addition, track-laying machines eliminated the problem of hauling ties over the roadbed where the railroad right of way was constructed (by fences, bridges, or high fills).

By 1900, three track-laying machines were in use: the Harris, the Roberts, and the Holman. These machines consisted of as many as 15 railroad cars and over 100 men. They could, however, easily produce 2.5 miles of finished track a day at a cost of $100 per mile.

As shown in the photo, the ties were unloaded from the rear of railroad cars on a series of rollers and were placed on the grade by hand. As a 30-foot length of tie was placed, the rail moved from the flat cars forward through a lifting derrick to be placed on the track and spiked by hand.

Many miles of Iowa's 10,000 miles of railroads were constructed with these machines.

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

IOWA STATE UNIVERSITY EXTENSION

LWSC present liability problems

Tort Liability

By R. L. Carstens
Professor Emeritus of
Civil and ConstructionEngineering

An 18-year-old high school youth drowned on May 13, 1983, near Cresco, Iowa, when he attempted to drive his car across a low-water stream crossing (LWSC) that was flooded. His car stalled about at the midpoint of the structure portrayed in the accompanying photo. His two companions had gotten out of the car safely, but the driver was still in the vehicle when it was washed away. His body was found two days later about half a mile downstream.

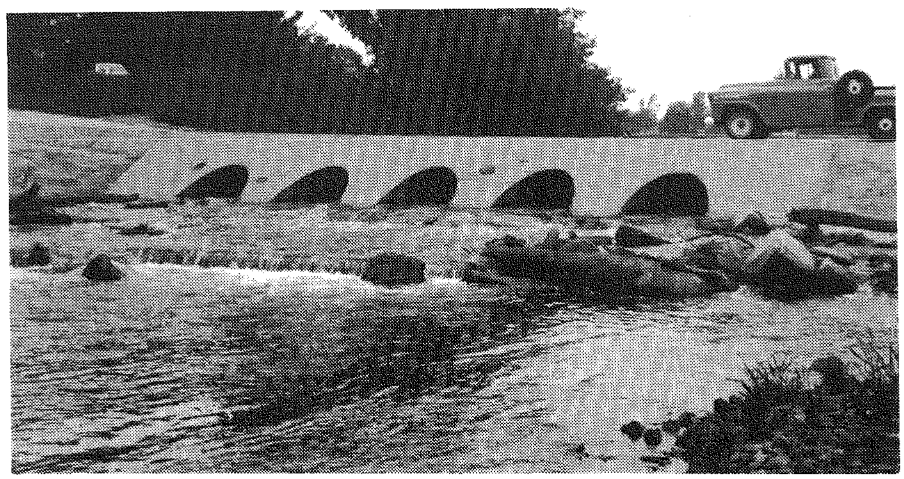
The youth's parents sued the county for over $4 million in actual damages and $2 million in punitive damages alleging negligence and nuisance. Specific charges included failure to close the road when water was flooding the structure, failure to maintain proper signs warning of danger, failure to install temporary barricades when the county knew or should have known that the structure was unsafe for traffic, and failure to have gates, cables or similar devices installed to indicate the structure when it was obscured by flooding waters.

The plaintiff's attorney and engineering expert (who was not an engineer) focused upon the signing on the approaches to the structure when the case was being tried to a jury. The signs in use included two warning signs and a regulatory sign on each approach. Legends on the warning signs read, in order, FLOOD AREA AHEAD and IMPASSABLE DURING HIGH WATER. Those signs were black on yellow. The regulatory sign, black legend on white background, read DO NOT ENTER WHEN FLOODED. This sequence of signs was consistent with the recommendations resulting from a study by the writer for the Iowa Highway Research Board. (See "Liability and Traffic Control Considerations for Low Water Stream Crossing," Final Report, HR-218, ISU-ERI-Ames-81204, April 1981.) The jury rejected the plaintiff's arguments and returned a verdict for the county, apparently concluding that the signs in use adequately protected the public.

The type of accident that afforded the basis for this case occurs frequently and has resulted in many claims against highway agencies in several states. In this case, the defendant prevailed. However, such a verdict cannot always be expected and reflects, in part, circumstances unique to this particular case.

The writer, who testified for the defense, and the attorney representing the defendant are agreed that the plaintiff's attorney and expert (both now deceased) did not present very persuasive arguments to support their claims. There is also the feeling that had the plaintiffs been willing to engage a competent engineer as an expert, they might have been guided to more relevant and substantive issues concerning the design of the structure. They might have persuaded a jury of the validity of their claims.

A highway jurisdiction must recognize that the use of a LWSC is accompanied by a significant amount of liability exposure. The circumstances of their use as well as their design and traffic control should carefully follow the policies and guidelines established by that jurisdiction. Otherwise, the potential liability exposure can outweigh the financial savings involved in using a LWSC in preference to a conventional culvert or bridge.



A county successfully defended itself in a liability suit brought after an accident at this low water stream crossing. Other LWCS suits may not be as easily defended.

Fuel system purchase requires planning

Microtechnology

By Tom Maze
Program Manager

In the last "Microtechnology" article, I discussed the value of computerized fueling systems. In general, these systems pay for themselves in one to two years by reducing unaccountable fuel losses and by providing better fleet management information.

Thorough planning prior to the purchase is critical when considering any computerized system -- whether it be a CAD system, a pavement management system, or a fueling system. The manager must determine what functions are important to him or her in a fueling system. For example, besides collecting the quantity of fuel pumped, the manager should decide what additional data should be collected at the pump and how that data should be validated for accuracy. The manager may also want the system to generate summary reports and allow him or her to interrogate the database to determine summary statistics.

How the fuel system integrates with other computer hardware and software is another important consideration. Many vendors of microcomputer vehicle maintenance information systems advertise that their systems can accept data from fueling systems. However, automatic exchange of data between the two systems may not be as easy as most vendors report. A representative of a major fueling system manufacturer advises that automatic communication should be required in the specifications for a vehicle maintenance management system. He also advises buyers not to release the final payment until data exchange has been tested and is functioning. Managers may also want the fueling system to communicate with billing and accounting systems.

Another aspect buyers should judiciously investigate is system configuration. The configuration determines how pumps are supervised by computers or microprocessors and the communication links between pumps and the system's supervisor. However, currently available configurations can be boiled down to three classes, with new technology offering a fourth class.

Class one systems are the simplest and most common. They are a microprocessor or microcomputer supervising a single fueling site, with one or more pumps. If necessary, data can be sent to other systems by using telephone modems, floppy disks, or other magnetic media. Class one systems are very appropriate where equipment is fueled at only one site. However, when users fuel at multiple sites, multiple entries can compromise data integrity.

Many early fueling systems were class two systems. A minicomputer at a central location is used by these systems to control fueling at different sites simultaneously, which is one advantage of these systems. Another advantage is that a large, centralized computer offers greater flexibility and computing power. However, communication lines between computer and site are not reliable enough to provide fuel 100 percent of the time. Operators were forced to override the system when it malfunctioned and compromised the data's integrity.

Class three systems are a combination of both class one and two systems. They use an on-site microcomputer or microprocessor connected to a central computer. The redundancy of on-site and centralized control allows almost 100 percent reliability in providing both fuel and accurate data. The centralized system also allows simultaneous control over multiple sites and greater computing capability from a central computer.

Class four systems involve technology that only recently has been introduced into the market. Class four systems involve vehicles with onboard microprocessors. The microprocessors monitor performance parameters such as maximum engine RPM, oil pressure, engine temperature, mileage, etc., and communicate the information to the fueling system. One method for exchanging data between the onboard microprocessor and the fueling system uses a microchip key. The key records vehicle information when it is plugged into the vehicle and downloads the information to the fueling system when it is inserted into a data receiver at the fueling site.

Each configuration has its own unique advantages which make prior planning important. Planning should be done by the system purchaser before exploring specific models or system types. In the next "Microtechnology" article, techniques for gaining access to fuel (keys, cards, number codes, and microchips) are explored.

Circuit rider begins safety programs

The Local Transportation Information Center's new series of traffic safety programs began late last year when Safety Circuit Rider, Ed Bigelow, held traffic safety workshops for nine governmental agencies throughout the state.

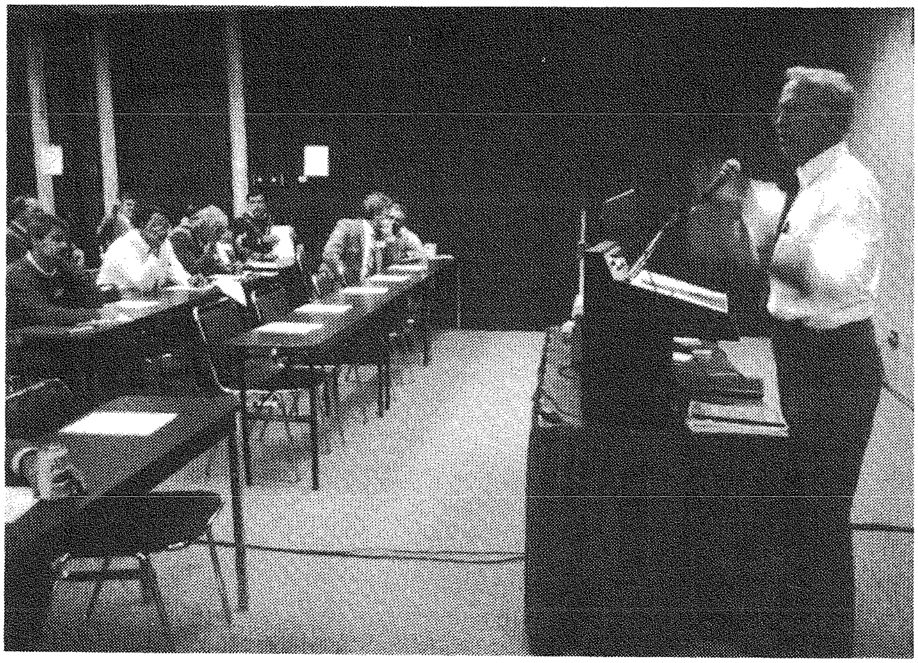
The safety circuit rider program provides transportation safety training to local street and road employees, demonstrates how training pertains to local conditions, and makes the training accessible to local employees by taking the program to them. The first program was held in Webster City for both the city and Hamilton County.

"We found the information very useful and well presented," Greg Malstrom, Webster City Public Works Director, said. "Ed gave us some good insight into some things we should check into. We were really interested in the ALAS (Accident Location and Analysis System)."

Making roads as safe as possible not only saves lives, but may also save money for the people of that city or county, according to Bigelow.

"There were 67,901 traffic accidents in Iowa in 1988, which is the last year for which totals are available. The economic cost was $717,000,000," Bigelow said. "Even the smallest county in Iowa had over $2,000,000 in losses that year due to traffic accidents. A 5 percent reduction would save $100,000 in just that small county."

Cities and counties can use ALAS to determine if they have any high accident locations. Once that location has been spotted, a study may show that relatively simple and comparatively inexpensive improvements can reduce the number of accidents.



Ed Bigelow presents a safety program to county engineers.

"My goal is to get the local street or road maintenance people and the local law enforcement people to work closely together," Bigelow said. "They need to take a good, thorough, and realistic look at their high accident locations and to do the common sense things necessary to reduce accidents at those locations."

Malstrom said having the presentation in Webster City — where 13 people attended the two-to-three hour meeting — made it possible for more people to attend.

"You want to be a little selective about who attends," he said. "But it involves more than the public works director and the chief of police. It also involves the people who put in the signs so they know what to look for."

The ALAS system is a computerized record of traffic accidents filed with the Iowa Department of Transportation by local authorities since 1977. A node-numbering system is used to record the location of the accidents. A local agency may request an accident history for any location in its jurisdiction from the DOT. Local governments usually request the most recent five-year history when studying high accident locations. By interpreting that history, the local agency can decide which corrective actions — if any — need to be taken.

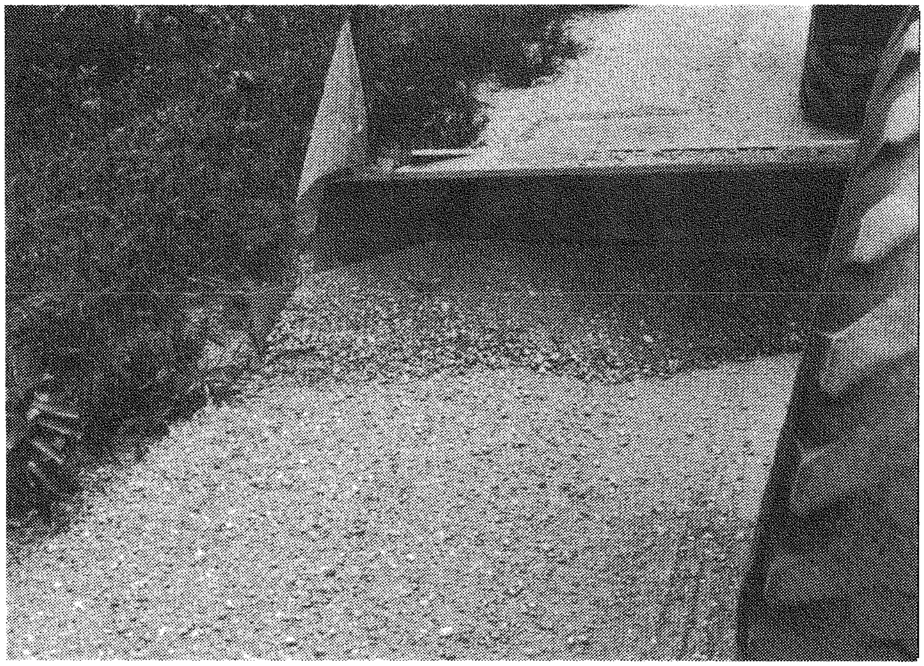
Bigelow plans to make presentations to six cities and counties each month. To schedule a safety session call Bigelow at 515/-294-6384 or write to: Ed Bigelow, Iowa State University, Room 325, Town Engineering, Ames, Iowa, 50011.

Tips From The Field

Gravel savers reduce aggregate loss

Improper motorgrading techniques can cost a county thousands of dollars in wasted aggregate. But techniques covered in The Local Transportation Information Center's Motorgrader Operator Course and gravel savers, originally used in Buena Vista County, can reduce aggregate loss.

The gravel savers are simple angles that can be cut out of old blades. The degree of the angle depends on the orientation of the blade. Once made, the gravel savers are bolted on over the mold board blade.



Gravel savers bolt over mold board blade.

"When you try to pick up the windrow at the edge of the road it gets so far off on the shoulder that you lose a lot of aggregate," Buena Vista County Engineer Don Linnan said. "The gravel saver idea just came up one day out of concern that we were losing too much out of the end of blade. We've had them for about 15 years."

Linnan said that the county shop fashioned them at first, tinkering with the design until it worked. Now, a local manufacturing firm makes them for the county.

Linnan said the gravel savers make a flatter windrow, which is safer for motorists.

The gravel savers are used just for maintaining operations. Operators remove them when they cut and shape the road. For more information call or write Don Linnan at Box 368, Storm Lake, Iowa, 50588, 712/749-2540.

Pavement management system continued from page 1

program to establish which road segments most need repair, possible repair strategies, and the cost of each strategy. The program is designed so that each individual agency can assign its own parameters, such as cost of repair materials.

"This program offers local officials a way to use their own staff and integrate pavement evaluation and management into their daily routine," Cable said.

Pictorial distress references and checklists provide field staff with a convenient means for conducting the survey. The menu driven analysis program enables the engineer or the staff to analyze individual pavements or entire systems in minutes. Rehabilitation strategies and costs can be revised as quickly, by those in charge, to meet local circumstances.

"The program is operated on common MS-DOS computers. It requires a minimum of one day of training and comes with a user manual," Cable said. "It is the result of listening to the needs of Iowa county and city engineers."

For More Information

The publications listed in this column are available on a loan basis by calling or writing John H. Moody, Iowa State University, Local Transportation Information Center, 194 Town Engineering, Ames, Iowa 50011 515/294-9481.

"Roadway Lighting Handbook Implementation Package 78-15"
This 248-page manual, published in December 1978, assists the engineering community in responding to lighting needs. It presents the basic principles of design, installation, operation, and maintenance of lighting systems for streets and highways. It is envisioned that this handbook will be used in combination with accepted standards and lighting practices. **Request index #53.**

"Roadway Lighting Handbook (Designing the Lighting System)" Addendum to Implementation Package 78-15
This 50-page manual, published in September 1983, is an addendum to Chapter 6 of index #53. Its thrust is primarily directed toward the design of a lighting system for streets and highways. **Request index #54.**

The Hole Story (1989 Edition)
This 14-page pamphlet deals with the causes of potholes and the importance of repairing them correctly the first time. It also goes into the economic impact of potholes, taking into account age, increased traffic, economic inflation, and deferred maintenance. **Request index #15.**

Pavement Patching Guidelines
This 72-page report published in 1983 presents guidelines for pavement patching. "How-to-do-it" recommendations are presented for constructing patches in cold weather (emergency basis), cold weather (routine basis), and warm weather (routine basis). Patching of flexible, rigid, and composite pavements is addressed. Recommended patching techniques including use of bituminous and portland cement patching materials are discussed. **Request index #22.**

"A Summary of Proper Cold Weather Pavement Repair Methods"
This 12-page publication by Robert A. Eaton of the U.S. Army Cold Regions Research & Engineering Lab. refers to two other publications by CRREL, namely "Pothole Primer" (Index #24) and "Engineer's Pothole Repair Guide" (Index #51). Its main thrust is the need for proper equipment and procedures for the preparation of a permanent pothole patch during cold weather. **Request index #627.**

"More Effective Cold, Wet Weather Patching Materials for Asphalt Pavements"
This manual details the tests of mixtures designed specifically for stockpiling and used for patching in cold, wet weather. More than 40 experimental binders were evaluated in the laboratory and five of these were chosen for field trials of which 410 were conducted and monitored over a one-year period. **Request index #596.**

W-Beam Guardrail Repair and Maintenance
This 34-page manual published in 1989 by the U.S. DOT and the FHWA is divided into 10 chapters ranging from Guardrail Safety and Site Review to Records of Repairs and Maintenance. **Request index #647.**

Publication order form

To obtain the materials listed from The Center, return this form to The Local Transportation Information Center, Iowa State University, 194 Town Engineering, Ames, IA, 50011.

Name ______________________

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Title	Index No.	No. of Copies

___ **Please send a complete listing of all publications from your office.**

___ **Please send a complete listing of all audio visual materials available**

Conference Calendar

Better Concrete Conference Feb. 6, Gateway Center, Ames. Contact Janet Gardner 515/294-5366.

Iowa Concrete Paving Association Annual Meeting, Feb. 14-16, Marriott Hotel, Des Moines. Contact ICPA 515/287-0606.

Asphalt Recycling Conference, Feb 21, Scheman Building, ISU, Ames. This conference covers common methods used in hot and cold recycling and procedures to determine recyclability of pavements.Contact Jo Sedore, 515/294-4817.

Liability and Traffic Signing, February 28, Western Community College, Council Bluffs and March 1, Iowa Valley Community College, Marshalltown. This workshop trains maintenance personnel in the proper use and maintenance of traffic control signs and addresses the liability implications of proper signing. Contact Janet Gardner, 515/294-5366.

Construction Inspectors Workshop, March 7, Western Iowa Tech, Sioux City; March 8, Des Moines Area Community College, Ankeny; March 21, Scott Community College, Bettendorf; March 22, Hawkeye Tech, Waterloo. This workshop is provides construction inspectors an understanding of the importance of their job and the fundamentals of construction inspection. Contact Jo Sedore, 515/294-4817.

Management for Street and Road Maintenance Supervisors; March 13, Southeastern Community College, West Burlington; March 15, Scheman Building, ISU, Ames. This seminar covers basic management techniques for newly promoted supervisors. Contact Janet Gardner 515/294-5366.

APWA, Iowa Chapter Spring Conference, March 15-16, Scheman Building, ISU, Ames. Contact Connie Middleton 515/294-6229.

MOVITE Spring Meeting, March 21-23, Omaha. Contact Kyle Anderson 402/895-3905.

Local Road and Street Pavement Management, April 11-12, Scheman Building, ISU, Ames. This workshopteaches the Iowa State Pavement Management System. Contact Connie Middleton 515/294-6229.

8th Equipment Management Workshop, Sponsored by the Transportation Research Board in cooperation with IDOT and ISU, May 28-30, Marriott Hotel, Des Moines. A national conference on the latest equipment management techniques. Contact Angelia Arrington 202/334-2934.

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