roads bridges transit

technology news

August 1988

54 supervisors learn management systems

As revenue shrinks and infrastructure crumbles, public agencies are feeling the pinch. To meet increasing demands for improved services, many agencies are turning to equipment management and maintenance management systems.

Management systems can be the key to doing more with less, according to FHWA's Mike Pellet. He recently taught workshops on the systems in Ames. Sponsored by the Local Transportation Information Center, the FHWA workshops were attended by 54 local highway and roads' supervisors.

The management systems have proven effective. After introducing an equipment management system, one county in Colorado was able to serve 20 percent more pieces of equipment with 20 percent less people. The operation saved the county $1.5 million in 4 years. A city in Indiana improved its maintenance system and was able to save $76,000 last year alone. These are two of many success stories told by Pellet.

The maintenance management systems help supervisors define work activities and standards; develop a roadway features inventory, work program, and performance budget; allocate manpower, materials, and equipment; perform short-term scheduling; control assignment and performance of activities; and evaluate the program.

Equipment management systems help managers develop a long-range fleet program to maximize equipment; improve maintenance to decrease down time and repairs; layout and implement an inventory system; maximize manpower, materials, and equipment; and create an integrated information system to plan, record, and track equipment repair and use.

"The workshops teach managers how to collect facts in ways that they can use and manage them," Pellet explained. "In the past, managers had the information, but it wasn't organized so they could use it. The system tries to give managers and supervisors control. The key way is to have a plan. Without goals or plans, you can't tell how you're doing or what you've accomplished.

The systems were designed to be implemented slowly and adapted to an agency's needs. Agencies can start with the parts of the management system that are most important for them and add more slowly. Due to a lack of staff and resources, most road organizations can't successfully implement a full system at once, he said.

Response to the workshop was excellent. Waterloo Public Works Director John Meyer thought he benefited greatly. "It reinforced things we've done for years to show we're on track. It will help us develop good performance standards and give us a better handle on inventory. Most important, it will help us get into a position where we're acting and not just reacting to problems," Meyer said.

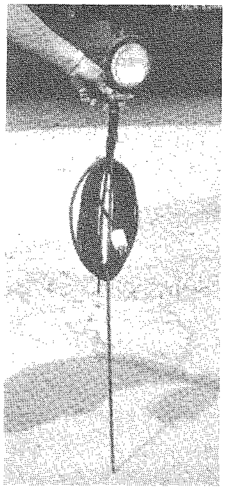
Cedar County has been using a modified maintenance system for 5 years. "It's no more squeaky wheel," said Cedar County Maintenance Foreman Todd Swick. "We've been able to document and work under a priority system."

Under contract to FHWA, Pellet's firm developed easy-to-understand manuals on each system. These excellent resources can be borrowed from our office by contacting John Moody at (515) 294-8817.

In this issue...

tips from the field

Portable 12-volt trouble light



The Ames Water Department has devised a portable 12-volt trouble light that plugs into regular 110-volt plugs adapted to the 12-volt system on all their trucks. The beam is bolted to a length of old sewer rod which can be driven into the ground wherever the light is needed.

Sealed 12-volt beams, wire, and plugs were purchased at a parts store for a total cost of $10 per unit. The sealed beam has a hinge mounted on the back so the light can be aimed at the work area.

For more information or specifications, contact John Moody, Iowa State University, Local Transportation Information Center, EES Bldg. Haber Road, Ames, Iowa 50011; (515) 294-8817

Highway research reports available

Copies of the following research reports are available from Vernon J. Marks, Office of Materials, Iowa DOT, Ames, IA 50010; phone (515) 239-1447. When ordering, please request by both title and number.

Production of Acetic Acid for CMA Deicer (HR-304)

Because it is a relatively non-corrosive deicing salt, the exclusive use of Calcium Magnesium Acetate could greatly reduce corrosive deterioration of vehicles and highway structures. Unfortunately, it is also expensive. This research identified the fermentation of 3 by-products of the wet milling of corn to reduce the cost of acetic acid. The by-products could be used to produce acetic acid, but more research is needed to determine the most inexpensive method.

Development of a Conductometric Test for Frost Resistance of Concrete (HR-272)

ISU conducted this research to identify a quicker, less labor intensive, more efficient method of determining the durability of concrete. Under the current Iowa DOT test, 4 inch x 4 inch x 18 inch concrete beams are placed in a freeze/thaw cabinet and removed twice per week for measurement. This research proved that conductance could be used as a viable method for continuous monitoring concrete durability without the removal of the beam twice per week from the freeze/thaw chamber.

Alternative Flexible Overlays (HR-229)

This study sought to determine if any of a variety of cutback and emulsified asphalt plant mixed and road mixed overlays could resist thermal cracking at low temperatures without causing shoving or rutting at high temperatures. Sections of 2 Osceola County roads were divided into 14 test sections of different lengths. After 6 years, the results showed that for low volume roads an MC-3000 asphalt cutback cold mix can reduce the amount of reflective cracking when compared to an AC-5 hot mix.

Construction and Evaluation of Submerged Vanes for Stream Control (HR-274)

The study evaluates the use of submerged vanes ("Iowa Vanes") to control bank erosion on a bend of the East Nishnabotna River at Red Oak. Bank movement was stopped or greatly reduced and vane design is continually being improved.

A Low-Cost Automatic Weight and Classification System (HR-282)

The report covers the demonstration of a low-cost Automatic Weight and Classification System (AWACS). The AWACS were tested in PCC and ACC pavement. The study showed that in the PCC pavement the AWACS could meet the needs of state and local highway agencies and produce accuracies comparable to the expensive commercial Weight-In-Motion Classification System.

Technology News is published by the Local Transportation Information Center, Iowa State University, ISU Extension--Business and Engineering, EES Building, Haber Road, Ames, Iowa 50011

Program manager--Tom Maze; Coordinator--John Moody; Editor--Teddi Barron; Editorial assistant--Brenda Stine; Computer programmer--Deborah Faul

The preparation of this newsletter was financed through the Technology Transfer (T2) Program. The T2 Program is a nationwide effort financed jointly by the Federal Highway Administration and individual state departments of transportation. Its purpose is to translate into understandable terms the latest state-of-the-art technologies in the areas of roads, bridges, and public transportation personnel.

U.S. Department of Transportation
Federal Highway Administration

DEPARTMENT OF TRANSPORTATION IOWA

IOWA STATE UNIVERSITY EXTENSION

micro technology

How to get started with a computer system largely depends on what you intend to do with the computer. For the purpose of this discussion, functions that are allocated to computers may be lumped into two categories: 1. general purpose systems, and 2. dedicated or semi-dedicated systems.

For example, the machine I have on my desk (and I am using to write this article) is a general purpose system. In fact, it is even portable. I use it to do word processing, to run spread sheet and data base programs, to run special purpose programs such as traffic analysis software, and to communicate with other computers.

Dedicated and semi-dedicated computers are usually purchased to conduct a specific function. Common dedicated or semi-dedicated functions include pavement management systems, equipment management systems, computer-aided design systems, roadway feature inventory systems, etc.

First things first
With either type of computing system you should start at the same point.
1. First decide what functions you want to conduct on the computer.
2. Next decide what software you want to use. 3. Find a computer that will run your software at a desirable level of performance.

Your investment in the computer usually will be far less than your investments in learning the system, entering the data, or purchasing the software. By the time you've made the more important decisions of selecting functions and software, the choice of computer will have been considerably narrowed.

Think it through
The same order of decision making should be followed when selecting any system. But that's where the similarity ends. Implementing a dedicated or semi-dedicated system is far more challenging and should be treated with more care.

For example, suppose you intend to implement a pavement management system. The system you select has an excellent procedure for automatically identifying pavement maintenance and restoration treatments. However, the system can't generate cost estimates for alternative treatments based on your localized costs for materials and labor. A new system with cost estimation capabilities may require that different pavement distresses be collected, that the pavement is inventoried differently, and a different pavement evaluation sampling scheme is used. If you switch to the new system, much of the initial start-up cost of the old system is lost and your previously collected data is incompatible.

Making a selection error with a dedicated or a semi-dedicted system can be very costly because of costs associated with training, initial set-up, and data collected. My simple advice is, "you can't wait to see what you get until you know what you want."

Preview before purchase
Before buying a dedicated or semi-dedicated system, research the market, attend shows or schools where the type of system you are interested in will be discussed or demonstrated. Once you have a good idea of what you want, visit another jurisdiction that uses that system to get a clear view of its pros and cons.
Tom Maze, program manager, Local Transportation Information Center

Write and win!

If you've made an improvement at your agency, chances are others could benefit from hearing about your experiences. By writing about your successes, you could win a free registration to a workshop, conference, or course presented by the Local Transportation Information Center or civil engineering extension.

For example, if you've accrued measurable savings by implementing a pavement management system, a computer-aided design system, an equipment management system, or an automatic fueling system, we'd like to hear about it. Or, if you've come up with a system to better motivate, manage, and/or supervise your maintenance workers, you could win, just by sharing your experiences.

All you need to do is write a brief (2-4 page) description of your success story, and volunteer to answer our telephone questions regarding your experiences.

Based on selection by the Center's advisory board, we'll publish a 'success story' article in *Technology News*. If it's yours, you'll receive a free registration (worth between $25 and $250!) to the workshop of your choice.

We'd like to hear from you and share your good ideas with others! Send your success story to Tom Maze, ISU, Local Transportation Information Center, EES Bldg., Haber Road, Ames, IA 50011.

Common sense rules for maintenance and fleet management.

"Maintenance and fleet management, like any other management function, must have a plan."

Working on maintenance and fleet management can be rewarding. Many simple equipment management improvements can have a significant impact on a vehicle's performance and reliability. Moreover, many of the principles involved are only good, old, common sense.

A common misconception is that maintenance activities should be left solely to mechanics or to those with mechanical expertise. A mechanical background helps, but it is not necessary to manage and participate in the maintenance function. The benefits of assigning specific, planned, and systematic maintenance responsibilities to operators are proven. Several studies show that when operators are trained to make simple, qualitative, maintenance inspections before and after their operation, maintenance costs fall and vehicle reliability improves. Vehicle managers who are not concerned with maintenance planning must cope with chance failures and the potential liability of maintenance-related accidents.

Developing a maintenance plan

Maintenance and fleet management, like any management function, must have a plan. The manager must first define objectives, then develop the standards necessary to achieve the objectives. Standards include intervals between preventive maintenance (mileages between inspections), maintenance procedures (driver and mechanic inspection checksheets), fleet-management programs (vehicle-replacement programs), and maintenance policies.

Choosing corrective or preventive

Most important is the development of policies to govern the choice between corrective or preventive maintenance. Corrective maintenance occurs after a mechanical failure or a loss of mechanical serviceability. Preventive maintenance occurs at predetermined inspection intervals, typically scheduled by accumlated mileage, time, or condition of a part.

Every unit (component or part) within a vehicle can be maintained either preventively or correctively, so the manager must determine complete policy guidelines. Sometimes the choice is clear. For example, it is obviously better to allow an interior light bulb to fail rather than to preventively replace it before failure; its failure does not affect the safety performance of the vehicle. However, determining the best maintenance policy usually requires careful thought, planning, and an understanding of procedure for wise preventive maintenance design.

Blending two preventive maintenance approaches

There are two types of preventive maintenance: condition-based and fixed mileage. Both are powerful approaches that must be blended in a good preventive maintenance program.

With condition-based maintenance, approaching failures are predicted when a monitorable condition exceeds a tolerable limit. For example, in a preventive inspection, it should be replaced, even though it has not failed.

There are three types of condition-based monitoring.

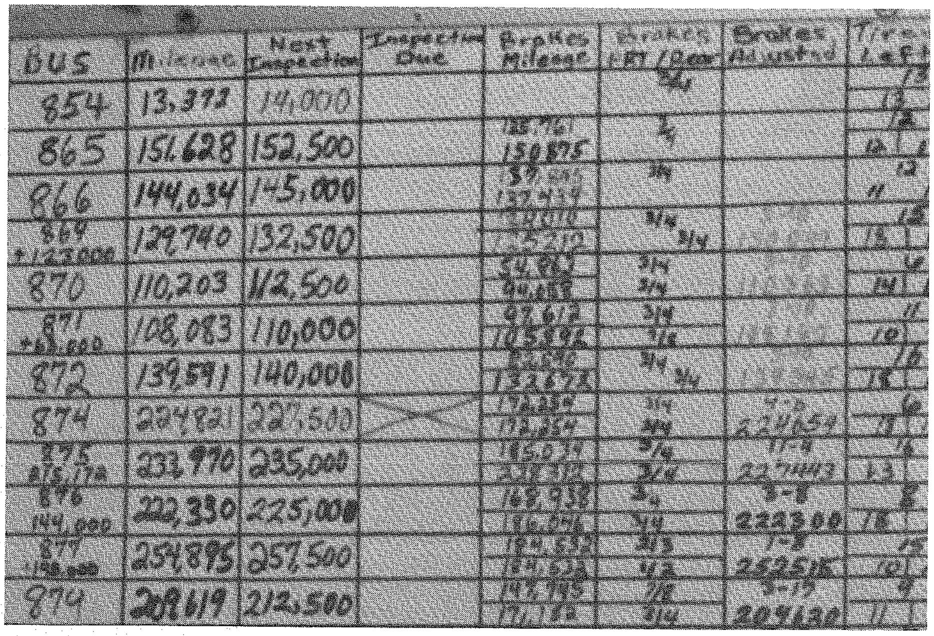
1. Qualitative inspections, usually made by operators and servicers/fuelers, and dependent on a regular familiarity with the vehicle's performance and condition.

2. Quantitative inspections, usually made by trained mechanics during a preventive maintenance inspection.

3. Trend monitoring; for example, fuel and oil consumption trends can be used to identify engine problems. The primary purposes of preventive inspections are to inspect for unusual wear or fatigue; to test the vehicle's condition and recommend repairs; and, if necessary, to adjust, tighten, add fluids, and replace filters.

Fixed-mileage maintenance activities are carried out at regular mileage intervals. This is most useful when a known relationship exists between the mileage traveled and the mechanism failure. For example, oil and oil filters are changed at specific intervals because they are known to deteriorate with use at a fairly well-defined rate.

In general, condition-based maintenance is preferable to



One example of a common sense maintenance planning tool is used by the Ames transit system, Cy-Ride: an erasable board that helps the fleet manager plan preventive maintenance inspections and anticipate routine repairs. For each vehicle, the board shows the mileage at which the next inspection is due, the mileage at the time of various routine maintenance procedures, and the vehicle's current mileage. At a glance, the manager can plan the preventive inspection schedule and determine which vehicles are likely to need other repetitive and routine repairs.

fixed-mileage maintenance because it permits the maximum use of each unit before failure. However, if necessary, fixed-mileage maintenance is usually preferred over operation-unit-failure.

Determining a preventive maintenance policy

Simple rules can be followed to select preventive-maintenance policies. However, the rules are developed for light-duty vehicles (e.g. vans, pick-up trucks, body-on-chasis buses, etc.) and not for heavy-duty vehicles (construction equipment, over-the-road trucks, integrated buses, etc.) Most types of heavy-duty equipment usually have very different life-cycles than light-duty equipment.

First, some terminology: components can be divided into two categories, assemblies and simple parts. An assembly is anything that can be disassembled into two or more components without disrupting a permanent physical bond. For example, a starter motor is an assembly and it can be dismantled into component parts. However, when a starter motor fails, the entire assembly is replaced, not just the failed components within the starter. A simple part is anything that cannot be dismantled without disrupting a physical bond. Examples of simple parts include spark plugs, radiator caps, batteries, and fan belts.

The simple rules-of-thumb for maintenance policy selections are:

1. In general, condition checks for simple parts and assemblies should be included in qualitative (daily driver) inspections and quantitative (periodic mechanic) inspections.

2. For simple parts (for which condition checks are uneconomical or impossible), develop mileage or time-based replacement intervals. Manufacturer's and third-party, maintenance manuals can be used to help develop intervals.

3. Use mileage-based replacement of assemblies only if the mileage between failures is consistent or if a failure may jeopardize safety.

Reviewing maintenance programs

Once a maintenance plan is developed, the manager should constantly review program performance to make sure it is achieving the objectives and to make necessary improvements. He or she should also develop a quality assurance program to make certain that the maintenance program actually complies with the management plan. This should include the development of a training program for operators, mechanics, and other staff personnel that come into contact with the vehicle; and random spot checks of maintenance actions.

Developing a fleet management plan largely boils down to good, old, common sense. Maintenance planning is mainly a matter of recognizing that there are two types of maintenance, studying each situation to reach a planned policy, and implementing the necessary maintenance standards and procedures.

Courts may be critical of warning sign placement distances

by R.L. Carstens, Professor Emeritus of Civil Engineering

We wrote in *Technology News* of March, 1986, of the liability problems arising from allegedly inappropriate longitudinal spacing of warning signs. The article mentioned six specific lawsuits where spacings were from 31 percent to 223 percent of the 750-foot spacing that the courts were told was appropriate. These six cases cost defendants nearly $3,000,000 in settlements and judgements.

The Manual on Uniform Traffic Control Devices (MUTCD) for many years specified approximate spacings of 750 feet and 250 feet for rural and urban signs respectively. This was modified in a recent change so that only minimum spacings are now specified. These spacings are set forth in Table II-1 of the MUTCD, reproduced below. We speculated in the earlier article that "those responsible for the placement of warning signs must be more attentive to the minimum distances prescribed for the placement of warning signs and also to the maximum distance where the motorist will retain the sign's message."

The reader will note in Table II-1 that the minimum spacing for a warning sign varies with the posted or 85th percentile speed and is also a function of the message. For example, a merge sign would be spaced at least 700 feet from the point where two roadways converge on a highway with a 55-mph limit. By contrast, a stop ahead sign on the same highway would be spaced at least 450 feet from the stop sign and a curve sign with a 40-mph speed advisory would be at least 300 feet from the start of the curve. Spacings at lower speeds are correspondingly less. Lawsuits are still being filed where it is being alleged that these minimum spacings were not provided.

The writer is not aware of cases alleging excessive spacing filed since the change in the MUTCD became effective in early 1983. However, such lawsuits are no less likely than when the single approximate spacing was specified. Spacings more than twice the minimum probably should be avoided for this reason. We cannot emphasize too strongly our admonition to those responsible for placing warning signs to be attentive to minimum and maximum placement distances. Otherwise, you probably will have to plead your case in court.

TABLE II-1—A Guide For Advance Warning Sign Placement Distance[1]

		General warning signs[3]					
Posted or 85 percentile speed MPH	Condition A high judgment needed[3] (10 secs. PIEV)	Condition B—Stop condition	Condition C—Deceleration condition to listed advisory speed—MPH (or desired speed at condition)				
		0	10	20	30	40	50
20	[5] 175	(4)	(4)				
25	250	(4)	[2] 100				
30	325	[5] 100	150	[5] 100			
35	400	150	200	175			
40	475	225	275	250	[5] 175		
45	550	300	350	300	250		
50	625	375	425	400	325	[5] 225	
55	700	450	500	475	400	300	
60	775	550	575	550	500	400	[5] 300

Typical Signs for the Listed Conditions in Table II-1; Condition A—Merge. Right Lane Ends, etc; Condition B—Cross Road, Stop Ahead, Signal Ahead, Ped-Xing, etc.; Condition C—Turn, Curve, Divided Road, Hill, Dip, etc.

1 Distances shown are for level roadways. Corrections should be made for grades. If 48-inch signs are used, the legibility distance may be increased to 200 feet. This would allow reducing the above distance by 75 feet.

2 In urban areas, a supplementary plate underneath the warning sign should be used specifying the distance to the condition if there is an in-between intersection which might confuse the motorist.

3 Distance provides for 3-second PIEV, 125 feet Sign Legibility Distance, Braking Distance for Condition B and Comfortable Braking Distance for condition C as indicated in *A Policy on Geometric Design of Highways and Streets,* 1984, AASHTO, Figure II-13.

4 No suggested minimum distance provided. At these speeds, sign location depends on physical conditions at site.

5 Feet

for more information

The following publications are available from the Local Transportation Information Center. To order, complete the form below.

Traffic Control Device Handbook #68

Primarily intended to augment the Manual on Uniform Traffic Control Devices (MUTCD), the handbook provides information related to traffic regulation and control, traffic control devices, current application practices, and traffic engineering techniques of the future. Sections included are signs, markings, signals, islands, work zone traffic control, school areas, railroad highway grade crossings, and bicycle facilities. Each section defines the types and purposes of the devices and identifies appropriate driver/pedestrian response. Copies are available for $5.00.

The Engineer's Pothole Repair Guide #51

Prepared by the Cold Regions Research and Engineering Laboratory, this 12-page booklet points out the importance and economy of repairing a pothole correctly the first time, instead of making repeated temporary repairs. It briefly covers types of failure and reviews the steps, materials and procedures needed for a satisfactory and permanent repair job. Free.

Pavement Stabilization by Undersealing Principles and Techniques #36

Void formation beneath the slab is a major cause of pavement failure. This 12-page booklet, published by ChemGrout, discusses the problem and describes detecting voids and undersealing to fill in small voids. Also included: materials, equipment, procedures, and special situations. Copies are free.

Pothole Repair Management #23

This practical guidebook comes with slides that illustrate background information for those responsible for pothole repair. Prepared by the Pennsylvania Transportation Institute of Pennsylvania State University, the guide provides in-depth information about the various types of pavements in Pennsylvania, the type of loading experienced, and the way potholes are formed. The guide also provides information on various materials used, the proper repair procedure required to ensure a long-lasting patch, and ways to increase productivity and better manage daily crew operations. Available on a loan only basis.

Pothole Primer #24

Specifically developed to assist elected officials and non-engineering adminstrators, this non-technical booklet highlights major causes and general solutions for pothole problems in asphalt pavements. It was prepared by the U.S. Army Corps of Engineers and the Asphaltic Institute. Copies are available free.

Hydrology #31

This 342-page manual provides a synthesis of practical hydrologic methods and techniques to assist in the analysis and design of highway drainage structures. Topics include hydrology, surface runoff, peak flows, frequency analysis, regression equations, unit hydrographs, design storms, routing, urban hydrology, and risk analysis. The manual was prepared by Stottler, Stag and Associates, Inc. with technical guidance from the FHWA Hydraulics Branch. Copies are available free.

Publication order form

To obtain the materials listed as available from the Local Transportation Information Center, return this form to the Local Transportation Information Center, Iowa State University Extension, EES Building, Haber Road, Ames, IA 50011.

Make checks payable to Business and Engineering Extension.

Name ______________________

Address ______________________

City/State/Zip ______________________

Phone (______)______________________

Title	Index #	Price	# of Copies

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

___ **Please send a complete listing of all audio visual materials available from your office.**

conference calendar

28 29 30 1 2 3 4 5 6

Iowa Traffic Control and Safety Conference
Sept. 15-16
Scheman Bldg., ISU
Safe and efficient transportation is the focus of the annual fall conference cosponsored by the ITCSA. Participants represent the engineering, education, and enforcement professions related to safety on streets and highways. Contact Connie Middleton, (515) 294-6229.

TRB Workshop on Equipment Owned by Public Agencies
Sept.19-22
Gulf Shores, Alabama
Angela Arrington, (202) 334-2934

Iowa Section ASCE Annual Meeting
Sept. 23-24
Coralville

Bridge Research in Progress
Sept. 26-27
University Park Holiday Inn, Des Moines
Overview of major research areas and brief summaries of research in progress. Contact Wayne Klaiber, (515) 294-8763.

APWA Snow Conference
October 5-6
Scheman Bldg., ISU
New innovations in snow and ice removal and prevention. Topics include equipment, snow and ice removal, buildup prevention, and operator and training research. Equipment display. Contact Connie Middleton, (515) 294-6229.

Tort Liability For Local Agency Highway Professionals
Oct. 7
Ames
The workshop examines the duties and responsibiliites of highway and traffic engineering professionals. Topics include, tort law, roadside hazards, work zones, records and forms, and court room procedures. Contact Connie Middleton, (515) 294-6229.

Missouri Valley ITE Section Meeting
Oct. 19-20
Overland Park, Kansas
Contact Gary Metcalf (913) 381-5252.

ASCE/ICEA Current Issues in Surveying Conference
Oct. 26-27
Scheman Bldg, ISU
Conference covers changing DOT practices in preliminary location and design surveys, highway structures, construction staking, GPS applications, title insurance survey requirements, liability, marketing, business, and electronic data. Contact Connie Middleton, (515) 294-6229.

ASCE Project Management Conference
Nov. 3
Holiday Inn, Davenport
Contact Connie Middleton, (515) 294-6229.

ASCE Transportation Conference
Nov. 9
Scheman Bldg., ISU
Contact Connie Middleton, (515) 294-6229.

ISU Conference on Engineering Ethics
Nov. 17-18
Scheman Bldg., ISU
Topics include engineering negligence, whistle-blowing, suppression or falsification of data, and misrepresentation in advertising. Contact Connie Middleton, (515) 294-6229.

ASCE Structural Design Conference
Nov. 29
Scheman Bldg., ISU
Contact Connie Middleton, (515) 294-6229.

Technology News

Iowa State University
ISU Extension
Local Transportation Information Center
EES Building, Haber Road
Ames, Iowa 50011-3074

DNF - ACR - RPG

Route to:

____

____