Technology News

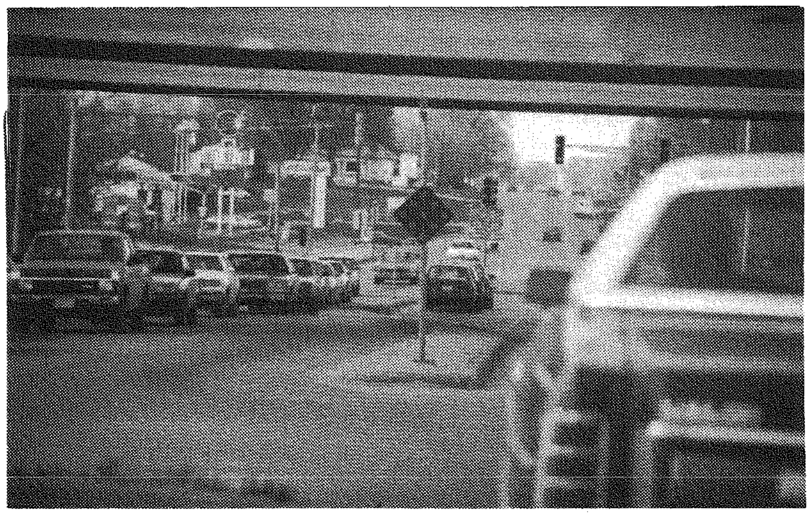
Roads Bridges Transit

Iowa State University
Business and Engineering Extension

Local Transportation
Information Center

March 1990

Law requires sychronization



Traffic signal coordination can save dramatic amounts of fuel each year. Results from a study indicate that signal coordination saves fuel and promotes a smoother traffic flow, especially at heavily used intersections.

Iowa cities with three or more traffic signals will have until July 1, 1992, to synchronize those signals according to an Iowa energy conservation law passed during last year's legislative session.

The law requires signal synchronization because in many cases it helps move traffic smoothly with less stops, starts, and idling. The payoff from synchronization is a significant saving of fuel. A smoother flow of traffic may also decrease the pollutants emitted by motor vehicles and make traveling less stressful for the driver.

The law, Senate File 419, section 7, states: "After July 1, 1992, all cities with more than three traffic lights within the corporate limits shall establish a traffic light synchronization program for energy efficiency in accordance with rules adopted by the state Department of Transportation."

Roger Anderberg, Urban Systems Engineer for the DOT, is in charge of formulating the rules. The rules have to be reviewed several times, but the process is on schedule for a May 9, 1990, effective date, according to Anderberg.

"The rules make an attempt to set some standards," Anderberg said. "It then defines what synchronization means. In this case, the rules say if a city has a system -- unless an engineering study says it's not practical -- then you shall have them coordinated. My claim is that most engineers don't use those words (practical, coordinated, synchronization) as the dictionary defines them and that leads to problems."

Jim Thompson, Director of Traffic and Transportation in Des Moines, said his city has over 300 signals and that about 200 are already interconnected. He estimated that it would cost the city approximately $3 million dollars to interconnect the rest according to the law.

"I think the DOT has done a good job in

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attempting to put together rules and regulations on a law that at best is going to be difficult for communities to follow," Thompson said. "They have done a good job of injecting traffic engineering judgment into the process to determine when you should or should not coordinate signals. But you have to do studies. For example, signal coordination may not be effective when a street has a lot of driveways that would break down the platoon of cars.

"One of the things we're looking at is whether or not that $3 million would be better invested in improving existing signals," Thompson said. "We may provide better service, for example, by updating our antiquated downtown signals to current technology."

In 1989, Johnson, Brickell and Mulcahy and Associates and the Local Transportation Information Center completed the technical assistance and evaluation portion of the Iowa Motor Vehicle Fuel Reduction Program. The program updated traffic signal equipment and retimed traffic signals in 19 communities. An overwhelming finding of the study was that there are tremendous fuel and delay savings available through coordinating traffic signals.

In some locations where coordination is technically feasible and traffic signal hardware is in reasonably good condition, signal coordination may require only the retiming of traffic signals. In such cases, the benefits are likely to be very large in comparison to the cost. In other cases, coordination may require a hardware investment. However, the Motor Vehicle Fuel Reduction Program has shown that even when the equipment costs are taken into account, the benefits generally greatly outweigh the costs.

"Conforming with the new law may require that some cities update or modify their traffic signal hardware," Tom Maze, Director of The Center, said. "However, in some cases, coordination of traffic signal systems along arterial streets may be possible through retiming signals. Even at isolated intersections, more efficient traffic flow may be possible through the use of more efficient traffic signal timing."

Although an individual driver may not notice significant savings in fuel, the Iowa Motor Vehicle Fuel Reduction Program found that the cities involved in the testing would save a total of 267,000 gallons of gasoline each year.

The Local Transportation Information Center currently has a limited amount of funding provided by the Department of Natural Resources, using oil overcharge monies, to help pay for retiming. The DNR will pay half of the cost of retiming existing signals as long as the city agrees to implement the new timings within six months.

"Basically, we have a contract with the Department of Natural Resources (DNR) to retime signals to save energy," said Mohammad Elahi, The Center staff member who will be doing much of the retiming. "We can count traffic volumes, retime the signals, implement timings, and fine tune the system once it's in. Plus, the law requires coordination and we may be able to help cities comply with the new law."

For more information on the signal retiming program or the findings of the Motor Vehicle Fuel Reduction Program, write or telephone Jan Graham, Iowa State University, 423 Town, Ames, Iowa, 50011 515/294-8082.

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

IOWA DEPARTMENT OF TRANSPORTATION

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More than the minimum required

Engineers faced with potential liability from a highway accident often respond that they "followed the manual." Reference is to the Manual on Uniform Traffic Control Devices (MUTCD). Let's look more closely at that response.

In an answer to a tort liability question posed in the *Technology News* for July 1986, we pointed out that the MUTCD is not a minimum standard but was published in response to a need for high uniform standards. This is stated in the Introduction to the manual. The answer elicited a response from the Director, Office of Traffic Operations, Federal Highway Administration, expressing the point of view that our answer was incorrect and that the "MUTCD sets forth minimum standards."

The writer's experience would suggest that both points of view are correct, at least in part. Reference to the lawsuits relating to traffic control devices with which the writer has been involved will help explain this position. Almost all of these cases have been concerned with either the use of stop signs or warning signs.

Warrants for the use of stop signs are stated in Section 2B-5 of the manual. The lawsuits that have resulted from accidents at uncontrolled intersections have not involved intersections with a "main road" or a "through road" and were not in a "signalized area." Thus, the operative warrant became that involving a combination of high speed, restricted view, or serious accident record. None of these terms are defined in the manual. Hence, litigation in these suits has degenerated into a contest between expert witnesses each seeking

Tort Liability

By R. L. Carstens
Professor Emeritus of
Civil Engineering

primacy for his or her definitions of high speed, restricted view, and serious accident record. Some of these definitions have been ludicrous, but probably no harm has been done since the trial results usually have ignored these considerations and were based on the extent of a litigant's injuries and other non-engineering factors. It is not clear whether the manual provision relating to the use of stop signs is a high standard, a minimum standard or simply not a usable standard at all.

common engineering practice and has come to be the normal expectation of juries as well as most drivers.

In a lawsuit involving warning signs, a plaintiff's expert will suggest that additional signs and\or beacons should have been used, no matter what was in place. This obviously is a response to what is perceived as a minimum standard. Again, jury verdicts tend largely to ignore such testimony and to be based on non-engineering factors.

The MUTCD is a standard. By definition, a standard establishes a level of adequacy that is to be equalled or exceeded. Although the MUTCD is indeed a high uniform

> "Follow only a minimum interpretation of the MUTCD, and you almost surely will be on the losing side when your decisions are challenged in court."

Most warning signs (the Railroad Advanced Warning is an exception) are covered by Part 2C of the manual. Use of all of these signs is covered by the general statement in section 2C-1 that describes typical locations and hazards "that may warrant the use of warning signs." All of the signs included in Part 2C are signs that "may" be used. The rest of Part 2C provides specifications for the design of these signs and sets forth conditions and locations where they may be used. Clearly, this is a minimum standard. An extensive use of warning signs on all roads carrying significant volumes of traffic is

standard, most engineers significantly exceed its requirements in the use of traffic control devices, where that latitude is permitted by the manual. This response is reasonable and hopefully is the kind of response envisioned when engineers say that they are "following the manual." At least, that is the type of response that is needed to successfully defend a lawsuit involving the use of traffic control devices. Follow only a minimum interpretation of the MUTCD, and you almost surely will be on the losing side when your decisions are challenged in court.

Accessing automatic fuel systems

Microtechnology

By Tom Maze
Program Manager

In the last two "Microtechnology" articles, I discussed two aspects related to the development of semi-automatic fueling systems: 1) the savings and benefits of computerized systems, and 2) the system configuration options. In this article, I discuss the various options for gaining access to fueling systems.

Figure 1 is a photograph of a traditional method used by local governments to control fuel use. Unfortunately, locking the pump and expecting all users to accurately record the vehicle identification number, quantity of fuel pumped, and vehicle mileage results in recording omissions and errors, and makes it nearly impossible to monitor minor pilferage. Further, unless fuel use reporting is rigorously enforced, records may be useless in identifying consumption rates.

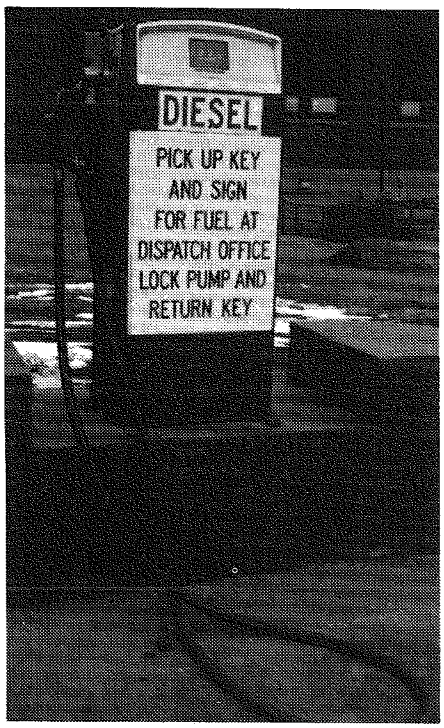


Figure 1

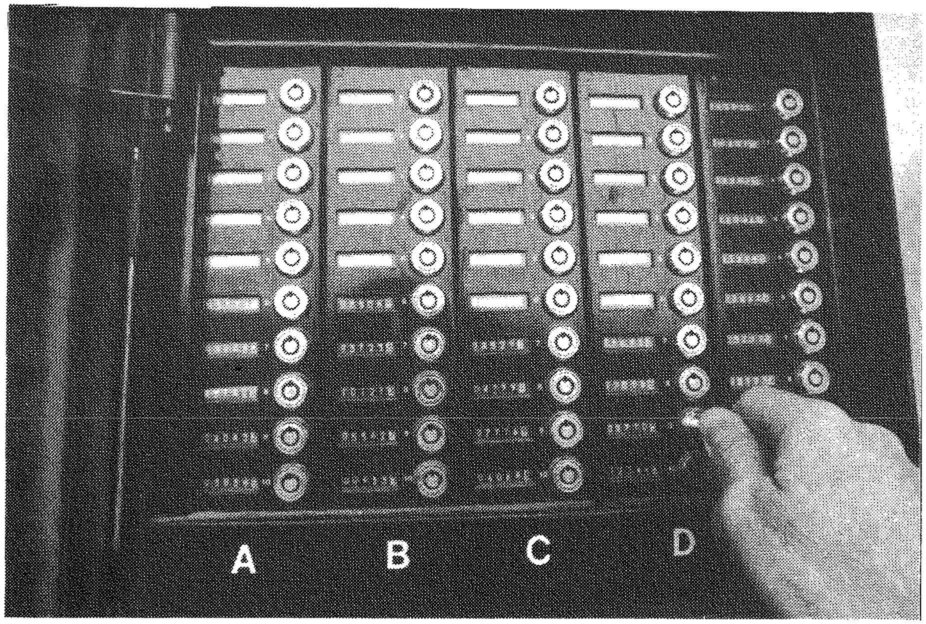


Figure 2

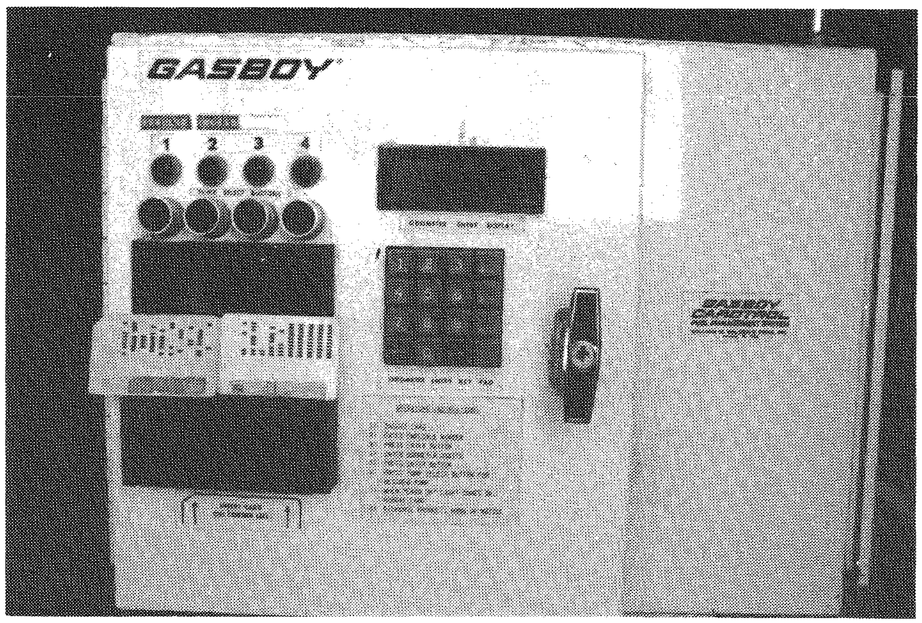


Figure 3

In the 1960s mechanical technology was introduced to help increase the integrity of fueling information and key systems were developed like the one shown in figure 2. With this system, each vehicle is assigned a metal key. The user turns-on the

Figure 4

Figure 5

pump with a vehicle-specific key and each of the dials records the gallons pumped into each vehicle. Although this system can provide accurate fuel information, it limits the number of users and requires the regular reading of dials to obtain fuel information.

In the 1970s, punch cards or optic-card machines were introduced. These machines feed computerized system information for automatic reporting. A picture of a two-card, optic-card system is shown in figure 3. One card identifies the vehicle and the other the user. One of the problems with this type of system is the limited amount of information that can be encoded on the card. Further, the cards can be duplicated by clever individuals that wish to pilfer fuel.

The next step in technology is the magnetic strip card. Like credit cards, these systems encode information on a magnetic strip on the back of the card. A mag-strip card system is shown in figure 4. These systems are generally quite well accepted and most users are accustomed to using mag-strip card equipment. The only disadvantages are that the card's data and the card itself are susceptible to damage.

Current technology makes use of microchip keys. One vendor's key is shown in figure 5. The primary advantage of these keys over mag-strip cards is that the information on the key may be rewritten and updated each time the user obtains fuel. This makes it possible for the microprocessor at the pump to run checks against the information on the key to make sure that the user is entering a realistic mileage and gallons pumped are reasonable in comparison to the miles traveled. Mag-strip card devices have to access a historical data base to run the same checks. In addition, the keys are almost indestructible.

In the implementation of any type of computerized system, the environment must be considered. All systems may have difficulty operating in sever cold, and damp/freezing conditions may leave systems inoperable. Protection from precipitation (rain, sleet and snow) and a heat source during cold weather should be considered to insure proper operation during all weather conditions.

Pickup walkway makes sign changes easier and safer

Art Smith, sign supervisor for Story County, safely changes signs by using a plank walkway attached to his pickup.

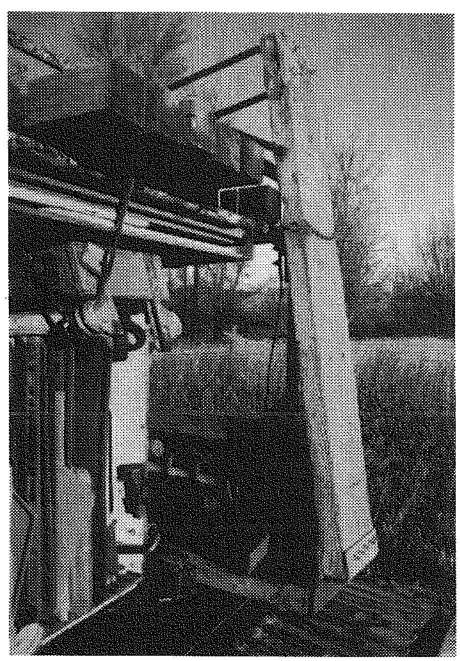
The walkway is simply a 2x12 board attached by hinges to a similar board that is bolted to the bed of the pickup. When not in use, the hinges let the board be swung up and secured out of the way.

When Smith changes a sign, he simply lowers the board. A cable connects the far end of the plank to the pickup for support. A simple railing is added for safety (see photographs).

When Smith and his assistant, Lee Blanchard, change a sign, they back the pickup to the edge of the road, partially blocking one lane, and lower the walkway. After placing safety warning devices according to the MUTCD, the pickup is backed up until the board reaches the sign. Smith simply walks to the end and changes the sign.

"I've seen times when the (sign) post was high enough that you had to stand on the very top rung of the ladder," Smith said. "That's not a very safe way to work. Plus, a post that may be weak is not the best thing to lean a ladder against."

Smith said the idea works well, not only making it safer, but more convenient to change signs. After removing a sign, Smith simply walks back along the plank to store it and to get the replacement sign.



Art Smith uses his walkway to help change a sign (above). When finished, it stores neatly at the back of the pickup (right).

With a new truck coming soon, Smith is planning to change the design. He wants to be able to park his pickup parallel to the shoulder instead of parking across the traffic lane. To do that, the walkway will be designed to lower from the pickup's right side.

For more information, write to Art Smith at the Story County Courthouse, Nevada, Iowa 50201.

For More Information

The publications and videotapes 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, Ames, Iowa 50011 515/294-9481.

"Traffic Management Errors and Misconceptions" This videotape discusses the problems of increased traffic volumes and their effects on drivers. Speed zoning is discussed extensively. Traffic signals are referred to along with problems experienced in cities. Traffic flow objectives and problems are discussed along with probable solutions. **Running time: 17 minutes. Request index #110V.**

"Emergency Relief" This videotape, produced by the Federal Highway Administration, outlines the procedures which might be followed in situations where transportation facilities have been disrupted by natural disasters. **Running time: 17 minutes. Request index #111V.**

"Idea Store -- Edition 1" This videotape, produced by the Pennsylvania RTAP Center, illustrates a number of ideas developed by "grass-roots" people in all parts of the country. The ideas relate to maintenance, engineering, equipment, communications, administration, training, and safety. There is an explanation of how to go about contributing ideas to be used in future editions. **Running time: 8 minutes. Request index #112V. Volume 2, request index #116V; volume 3 request index #135V.**

"Uses of Asphalt Rubber" This tape, produced by the Asphalt Rubber Producers Group, explains the processing of used tires into crum rubber, which, when mixed with asphalt cement, provides an asphalt-rubber mixture improving the characteristics of asphalt cement in seal coats. The tape may be accompanied by a four-page brochure which describes "Asphalt-Rubber Concrete (ARC), The Three Lay System" and "Stress Absorbing Membrane (SAM)." **Running time: 12 minutes. Request index #113V.**

"Roadside Design Guide" This 242-page manual, published by the American Association of State Highway and Transportation Officials, is divided into nine chapters and four appendices. The various sections cover economics, topography, drainage, sign and luminaire supports, roadside and median barriers, bridge railings, crash cushions, and safety appurtenance for work zones, all of which are related to roadside design. The appendices deal with cost effectiveness and design details. Manual costs $42 per copy. **Request index #641.**

"Comparison of Three Compactors Used in Pothole Repair" - Special Report, November 1984 This 14-page report by Michael A. Snelling and Robert A. Eaton of the U.S. Army Corp of Engineering at the Cold Regions Research and Engineering Laboratory is a summary of compaction study using recycled hot mix asphalt concrete conducted during in 1983 in an indoor facility at CRREL in Hanover, N.H. The study compared three types of compactors and also considered such factors as temperature of the asphalt-concrete mix, number of passes, size and depth of patches, and the number of lifts to fill the holes. **Request index #108.**

Publication order form

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

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Conference Calendar

Local Road and Street Pavement Management, April 25-26, Scheman Building, ISU, Ames. This workshop teaches the Iowa State Pavement Management System. Contact Connie Middleton 515/294-6229

APWA North American Snow Conference, April 8-11, Red Lion Hotel, Omaha, Nebraska, Contact APWA, 312/667-2200.

Motor Vehicle Fleet Management: Preventive Maintenance and Record Keeping, April 10, Southeastern Community College, West Burlington; April 24 Central Iowa Community College, Fort Dodge; April 26 Des Moines Area Community College, Ankeny; May 1 Western Iowa Community College, Council Bluffs. This workshop present the basics in motor vehicle equipment management, preventive maintenance program development, and record keeping. The program is oriented to keeping equipment data in a paper-based record keeping systems but the principals are equally applicable to computerized systems. Call Jan Graham 515/294-8082 for more dates and locations.

8th Equipment Management Workshop, Sponsored by the Transportation Research Board in cooperation with IDOT and ISU, May 28-31, Marriott Hotel, Des Moines. A national conference on the latest equipment management techniques. Contact Angelia Arrington 202/334-2934.

Getting Along With Your Microcomputer This is a workshop coming in June that covers the use of IBM compatible microcomputers. The course cover microcomputer technology, the MS-DOS^{tm} operating systems and the use of spread sheets in typical local government functions. The workshop is taught in a computer laboratory to allow hands-on participation. Contact Jan Graham 515/294-8082 for times and locations.

Automated Pavement Distress Data Collection Equipment Seminar, June 12-15, Scheman Building, ISU, Ames. Demonstrates latest pavement distress collection technology and the use of distress data for better management of pavements. Contact Jo Sedore 515/294-4817.

Construction Inspectors Workshop March 21 Scott Community College, Bettendorf; March 22 Hawkeye Institute of Technology, Waterloo. This workshop provides construction inspectors an understanding of the importance of their job and the fundamentals of construction inspection. For new employees, the course provides an excellent introduction to construction inspection. For the experienced inspector, the course refreshes the principles of construction inspection. Contact Jo Sedore, 515/294-4817, for more information.

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