

Technology

Roads Bridges Transit—

Iowa State University
Business and Engineering Extension

Iowa Transportation Center

News

December 1990

Strict bill pushes new fuels

By Tom Maze
Iowa Transportation Center

A few weeks after the Iraqi army marched into Kuwait, the price of gasoline shot up as much as 40 cents per gallon. This is a cold reminder that the country's foreign energy supply is at risk.

During the last 10 years, energy independence took a back seat to environmental concerns as the motive for developing alternative fuels. Research has focused on alternative fuels that are generally less polluting than gasoline or diesel fuel.

The pressure to create cleaner-burning motor fuels led to experiments with several non-petroleum based alternative fuels. More pressure was brought to bear by strict tailpipe standards from the Environmental Protection Agency for heavy-duty truck engines) and the 1990 Clean Air Act (really an amendment to the 1970 Clean Air Act). These standards are forcing manufacturers to explore alternatives to petroleum-based fuels.

The Environmental Protection Agency (EPA) used its administrative authority in 1985 to place tailpipe emission standards on truck engines. Those standards include reducing particulates to 0.1 gm/bhp-hr (grams per brake horsepower hour) and nitrogen oxides (NOX) to 5.0 gm/bhp-hr in 1994. Currently, state-of-the-art

diesel engines need special catalytic converters and particulate traps to meet those standards. Some heavy-duty engines using alternative fuels meet this standard without using particulate traps.

The strict emission standards force engine technology toward alternative fuels. In addition, regardless of the fuel and engine technology (or technologies) that eventually meet the

standards and are adopted by the engine manufacturing industry, it is certain that all heavy-duty engines will be electronically controlled in 1994.

The Clean Air Act of 1990 also sets a number of stringent tailpipe emission standards for light-duty equipment (less than 6,000 lbs GVW). These standards may force more use of re-

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Snowplow rodeo winners

Bob Fleck and Stan Erickson finished first in Class I and were the overall winners at the American Public Works Association Snowplow Rodeo held in October. The rodeo is a series of activities that test the participants' abilities in the areas of equipment maintenance, vehicle safety, and operations. The two work for the City of Bettendorf.

Francois speaks to county engineers

Saying that research is vital and that the nation is beginning to pay the price for underfunding its highway infrastructure, AASHTO Executive Director Francis B. Francois highlighted the 44th Annual Iowa County Engineers Conference as keynote speaker Dec. 4.



Milt Johnson

Also speaking were Scott County Engineer Bob DeWys, FHWA Division Administrator H.A. Willard, and ICEA President Nicholas Konrady. The engineers also heard NACE Executive Director Milt Johnson announce his plans to resign his position.

"The amount of traffic has tripled in the past 30 years," Francois noted. "The number of vehicle miles traveled is up 105 percent in the same time. Yet, highway funding has increased only eight percent. We're beginning to pay the price for underfunding."

Francois noted approximately \$68 billion is being spent for highways. However, \$80 billion is needed to maintain just the infrastructure cur-



Francis B. Francois, Executive Director of AASHTO, addresses participants at the 44th Annual Iowa County Engineers Conference. The conference was held at Iowa State University December 4-6.

rently in place and \$100 billion will be needed to fund improvements for anticipated increase in traffic flow.

"The outlook is murky (for additional funding)," Francois said, "because of the budget package."

Francois noted three aspects of the deficit reduction plan that is sapping the nation's highway funds. Those aspects are: a five-year package; a

cap on domestic (including transportation), international, and military spending; and half of a 5¢ fuel tax increase going into the general fund. On the positive side, the highway fund got a 20 percent increase in funding. That increase, according to Francois, is "getting close to the minimum funding level."

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IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY



Local agencies prepare for CDL test

Iowa became the 25th state to begin issuing commercial drivers licenses on November 1 and drivers for local government agencies are preparing for the test.

Preparation for the test is ranging from individual study to classes at community colleges. Some agencies are preparing their own training courses with materials supplied by the state, private businesses, and the trucking industry.

Nationally, close to 600,000 CDL's have been issued. According to the U.S. DOT, the national passing rate is better than 80 percent. Some states report passing rates above 90 percent.

"The number of those failing the CDL test may seem a very small percentage of the total," Tom Maze of the Iowa Transportation Center said. "However, because the number of commercial vehicle operators is large, even a small percentage represents a large number of drivers that no longer qualify as commercial vehicle operators.

"While it is difficult to determine how many individuals in local government will be required to have a CDL, there are 3.5 million truck and transit operators that fall under CDL requirements. If 10 percent of these operators fail the test, 350,000 new operators will have to be found to take their places. At the same time, the trucking industry is experiencing an extreme driver shortage."

"No one really knows how the CDL will affect the operator labor market. However, it is certain that CDL requirements will place more stress on an already strained labor pool," Maze said. "There are many differ-

ent ways that cities and counties can help their drivers with the test."

Story County Engineer Del Jespersen offers his 32 drivers a variety of study aids. They can work with audio cassettes, videotapes, and booklets but are responsible for studying on their own.

"We think that our people can handle it on their own," Jespersen said. "If that doesn't prove to be the case, then we'll set up some courses for them to attend."

On the other hand, Norma Todd, transit director for the city of Muscatine, has compiled a course for all city drivers. The city lists all employees who will need to get the CDL and holds training sessions for eight or 10 drivers at a time.

"We've gathered much of the information from tapes and workbooks and from a variety of sources," Todd said. "We've done it all in-house. The workbooks are so good that I don't think we're going to have any trouble."

Also in the planning stages are what Todd calls a rodeo for those who will have to take the driving test. However, many of the city's drivers will not have to take that portion of the test.

Pottawattamie County Engineer Jerry Hare is considering a training program. Since none of his drivers need to take the test immediately, Hare hasn't yet decided how the program will run.

"We're probably going to do something through the community college, but we don't know who will officially

run the program," Hare said. "What we intend is to have a six-or-eight hour session on company time."

Many agencies may want to consider giving their drivers a pre-test, as Todd is doing in Muscatine.

"We had a group meeting with all the drivers about what to expect and we did a sample test," Todd said. "It makes them aware of what they'll be facing when they actually take the test."

Jespersen, Hare, and Todd felt their drivers were less concerned about the test than when it was first announced.

"It started out as a real concern. But it seems as time goes on everyone has realized it's just something you have to give some effort to and you won't have any problems," Hare said.

Charles Fisher, Superintendent of Public Works in Spencer, said his drivers were still as concerned.

"They feel cities should be exempt from the requirements because we do maintenance-type activities as opposed to commercial hauling activities," Fisher said.

Drivers were concerned about the cost of a CDL. Initially, it was thought that the price would be high. But Walt McDonald, Commercial Drivers License Coordinator for the Iowa Department of Transportation, said the cost would be comparable to chauffeur's licenses.

Training videotapes and workbooks are available from the Iowa Transportation Center. Call John Moody at 515/294-9481 Monday, Wednesday, and Friday morning to order.

ITC mulls computer interchange

Microcomputers are being used in several counties and cities in Iowa to automate office functions. Naturally, most offices first use microcomputers for word processing. After that, microcomputers are used for financial analysis with spreadsheet applications and, finally, are used for designing. In discussions with county engineers, I'm estimating that between 30 and 40 Iowa counties currently use computer aided design (CAD) systems.

Growing computer use by Iowa local governments is promoting an interest in an electronic bulletin board service (BBS) to be operated by the Iowa Transportation Center. The original idea behind the BBS was to allow local government agencies easy access to Iowa Department of Transportation CAD drawings, as well as sharing information among themselves. These CAD drawings would be posted on the BBS so that they could be requested, or "downloaded", over telephone lines to the local agency's computer. However, a BBS can provide much more services than just access to CAD drawings.

The typical BBS can be accessed using a terminal or microcomputer with a modem. A microcomputer must have a terminal emulation program.

Typically, the BBS is operated on a microcomputer housed at a central location, like a transportation center or a DOT. Users may transfer files to and from the BBS, receive and send messages from other users, and access event calendars. Some technology transfer centers in other states maintain BBS that permit:

- downloading of public domain and shareware computer programs.

Microtechnology

By Tom Maze
Program Manager

- downloading and exchanging electronic copies of reports and abstracts.
- ordering of videotapes, slide programs, and documents from the technology transfer center.
- accessing event calendars and even electronic registration at technology transfer center workshops.
- downloading and exchanging of data files, including CAD files.

A BBS can be set up with different levels of security to protect files from

ware, four to six hours per week to maintain the BBS, and training workshops for potential users.

The resources needed to install, operate, and maintain an Iowa BBS have to be justified by local governments using and obtaining substantial benefits from the system. Although greater transfer of data through a BBS sounds appealing, a significant volume of electronic exchange must occur between users for the system to be justified. Occasional use would not warrant a BBS. Data files can be exchanged more effectively on an occasional basis by sending floppy disks through the mail.

Those that have successfully installed a BBS and have attracted an active user base, report incalculable

"Those that have successfully installed a BBS and have attracted an active user base, report incalculable benefits. Common users develop informal networks and exchange solutions to problems."

unwanted reading or copying. The BBS may have a directory which includes subdirectories devoted to software and files on various subjects. For example, one subdirectory could be devoted to pavement design and pavement management applications and another subdirectory devoted to computer utilities.

The resources that are required to set up and maintain a BBS typically include a microcomputer with a high-capacity hard drive, a modem, communications software, a dedicated telephone line, roughly one to two months to install and set up the soft-

benefits. Common users develop informal networks and exchange solutions to problems. Other users are able access software, data, and documents that they otherwise would not use or would not know about.

Over the next few months, we will be testing the waters to determine the interest in a BBS for Iowa's local governmental transportation agencies. Please express your interest or lack of interest to us at the Center or through the Iowa County Engineers Association, the Iowa Chapter of the American Public Works Association, or the Iowa Public Transit Association.

Fuel research continued from page 1

formulated gasolines (gasoline that is altered from pure gasoline — for example, gasohol is a reformulated gasoline). They are not likely to alter engine technology to the extent that heavy-duty engine standards will.

The Clean Air Act of 1990 includes very strict emission standards for fleet operators in air quality non-attainment areas. These standards are for trucks of less than 26,000 GVW and they implicitly promote alternative fuel use.

Presently, the most viable alternative fuels are compressed natural gas (CNG), ethanol (grain alcohol), methanol (wood alcohol), and liquid petroleum gas (LPG). Solar/electric and hydrogen alternative fuels have potential for future use, but the technology is not currently practical for widespread use.

Each of the front-running fuels have their drawbacks when compared to conventional fuels. CNG is currently the most cost efficient from a unit of energy (BTU) per dollar standpoint. CNG also has the most widespread distribution system — most cities have natural gas distribution systems. However, each unit of energy delivered in natural gas requires roughly 1,000 times the space of gasoline, thus requiring natural gas be highly compressed to reach similar operating ranges as gasoline. CNG is generally compressed at 2,400 to 3,000 psi.

CNG's high compression requires either an expensive fast-fill compressor or a slow-fill compressor (perhaps taking over night to refuel), and heavy onboard fuel tanks. On average, the fuel and fuel tanks of a gasoline automobile account for about 10 percent of the vehicle

weight while with CNG vehicles, the fuel and fuel tanks account for about 36 percent of the vehicle's weight.

The agriculture industry touts ethanol as an alternative fuel. Ethanol, made from corn, is more expensive per unit of energy than any of the other front-running alternative fuels. Given current ethanol production techniques, petroleum would have to cost roughly \$60 per barrel to provide the same cost per unit of energy. Given that petroleum is currently at about \$30 per barrel, ethanol production technology will need to be considerably more efficient to be cost competitive.

Ethanol's primary role, in the near term, will be as an additive to reformulated fuel. Ethanol acts as an oxygenate and reduces pollutants in tailpipe emissions. The demand for oxygenates forced by the 1990 Clean Air Act is likely to stimulate tremendous growth in the ethanol production industry.

Methanol may be made from wood, coal, or other woody vegetation but commonly uses natural gas as feed stock. About 40 percent of the energy in natural gas is lost in the conversion, but methanol is a liquid and more easily transported than natural gas. On a unit of energy basis, methanol is less expensive than ethanol but more expensive than CNG. It is very corrosive and is quite toxic — ingesting three to four teaspoons is usually fatal.

Like CNG, LPG is a gas. Unlike CNG, LPG is more energy dense. LPG is generally compressed and stored in liquid form at 175 to 250 psi. Therefore, LPG tanks are not as heavy as CNG tanks. Depending on the location and LPG market condi-

tions, on a unit of energy basis, LPG is roughly the same price or slightly more expensive than CNG. However, LPG does not have the widespread distribution system of CNG. Another drawback is that LPG is a petroleum production by-product. LPG supplies are therefore tied to the same unstable sources as petroleum fuels.

All of the front-running alternative fuels are hazardous and present new risks to operators and vehicle maintenance personnel. For example, the introduction of any these fuels will place more importance on ventilation in maintenance workspaces.

The capital cost of the fuel production, distribution, delivery, and refueling systems for each of the alternative fuels present a significant barrier. Because of the capital costs associated with replacing conventional fuels with alternative fuels, reformulated gasoline and diesel fuels present a significant potential for use as a clean-burning fuel.

Reformulated fuels are altered to reduce harmful emissions. For example, reformulated gasoline will contain lower levels of aromatics, such as benzene, have a lower vapor pressure, and incorporate oxygenates such as methyltertiary butyl ether (MTBE), ethyltertiary butyl ether (ETBE), or ethanol. Reformulated fuels are attractive because they will use the same distribution chain as conventional fuels and can be burned in conventional engines.

For more information on alternative fuels, call or write to John Moody at the Iowa Transportation Center and we will send you a document on the fuels and work place hazards they present.

Tips From The Field

Bright idea keeps controllers warm

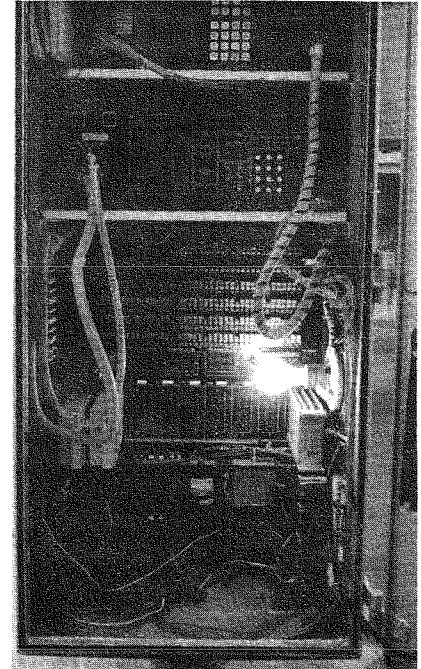
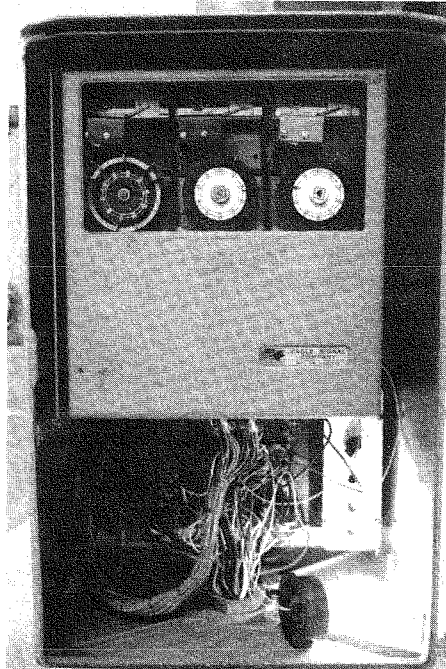
Keeping equipment working when the temperature falls below freezing is a constant battle, and traffic signal control boxes are not exempt.

An easy way to keep both mechanical and electrical control boxes working throughout the winter is to install a socket and light bulb, according to Don Swan of the Des Moines traffic signal department. Heat produced by the light bulb keeps the temperature inside the controller box at around 32° F.

"We put bulbs in the controller boxes at the heavily-used intersections," Swan said. "We start installing them in the fall and take them out in the spring."

Spare sockets and bulbs from signal heads work, as do standard bulbs. Swan recommends 60 and 100 watt bulbs. Wire one of the socket "lead" wires to a neutral contact and the other to a "hot" contact. Putting in the bulb finishes the job and keeps the controller box warm for the rest of the winter.

The bulb should be placed away from any of the wires in the box. The



A simple socket and light bulb can keep traffic signal control boxes working throughout the coldest weather.

heat will eventually melt the insulation and cause the controller to fail.

The city of Des Moines orders new controller boxes with sockets already in place. Although these are intended for work lights, simply leaving the light on keeps the controller warm.

The same idea can be used in other equipment. For example, the city of Indianola found that extremely cold temperatures inside of its fuel allocation control shed kept the system from dispensing fuel. A high-intensity bulb in the shed keeps the temperature high enough for the system to work.

Francois continued from page 2

Pointing out that the Surface Transportation Bill is up for renewal, Francois noted that Congress will have to debate several important points; such as: how long will the bill run and whether new management

techniques like pavement and bridge management systems should be mandated. Congress will also have to consider how much research to support.

Research is one of two areas AASHTO is placing emphasis on, according to Francois. The other area is software. AASHTO is spending \$5 million on developing software for highway agencies.

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.**

Controlling Drifting Snow — This short paper by Professor Emeritus Stan Ring explains how snow drifts are formed. He also explains where snow fences should be placed to keep drifting snow off streets and highways. **Request index # 718**

Reference Booklet of the 20 Most-Used Tables in Highway Maintenance — This is a handy booklet published by the Federal Highway Administration. It contains 20 tables on acreage, square measure, application rates, volumes and weights, storage capacities, and conversion factors. A very helpful tool for maintenance workers and supervisors. **Request index #11b**

Pothole Primer — This 24-page booklet published jointly by the Army Corps of Engineers and the Cold Re-

gions Research and Engineering Laboratory is a guide to the major causes and general solutions to potholes. The booklet was prepared in 1981 to assist elected officials and non-engineering administrators of cities and towns in understanding and managing their pothole problems. An attempt has been made to keep the booklet as non-technical as possible so that non-engineers can use it. There are still a number of copies available. **Request index HD.24**

Pothole Repair in Surface Treatment Pavement — This tape, produced by Roy Jorgesen and Associates for the International Road Federation (IRF), takes the viewer step-by-step through the pothole repair procedure from placing traffic control devices to cleaning up the work site when the job is completed. A four-page booklet prepared by Rita G. "Tinka" Jones of the Louisiana Research Center may be requested with the tape. **Running time 13:28; Request index #66V**

Repair of Depressions, Rutting and Corrugations — This tape, produced by Roy Jorgensen and Associ-

ates for the IRF, shows how to repair road surfaces which have depressions, ruts, and corrugations. The tape covers how to place traffic control devices, site clean-up, and restoring traffic to normal. It specifies necessary equipment, tools, and materials required to complete the job. A three-page booklet prepared by Rita G. "Tinka" Jones may be requested with the tape. **Running time 13:42, Request index #68V**

Single and Multiple Surface Treatments — Produced by the IRF, this tape deals with those roads requiring repairs to their surfaces (on a single surface treatment involving a layer of asphalt material over which a layer of aggregate is placed and rolled.) Multiple surface treatment is a combination of two or more single treatments. This tape goes through the eight-step procedure from traffic control to cleaning up the site. It also specifies needed tools, equipment, and materials. If requested, it can be accompanied by a three-page printed supplement prepared by Rita G. "Tinka" Jones. **Running time 14:17; Request index #70V**

Publication order form

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

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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

Aggregates in Transportation January 17, Scheman Building, ISU, Ames This conference is designed to assist the engineer, contractor, and aggregate producer in understanding the problems each faces in providing a quality product for public transportation. Contact Connie Middleton 515/294-6229

Asphaltic Concrete Paving Conference January 29, Scheman Building, ISU, Ames This conference is designed to inform the construction and design elements of the highway industry of the innovations in the design, construction, and operation of asphalt highway and runway surfaces. Contact Carole Seifert 515/294-1400.

Hydraulic Design of Bridges and Culverts February 12-14 Scheman Building, ISU, Ames Designed for the new county engineer or consultant who is beginning to design culverts and bridges. The participants will solve design problems using both charts and a microcomputer

program. Contact Connie Middleton 515/294-6229.

Vehicle Fleet Management: Preventive Maintenance February 27 - Cedar Rapids, March 5 - Sioux City This workshop provides basic knowledge of equipment management, preventive maintenance programming, and maintenance planning. Call 515/294-5642.

Roadside Design Guide TBA - ISU, Ames This workshop enables participants to recognize roadway design hazards, understand the clear zone concept, and apply safety concepts to roadside features. Call 515/294-5642.

Liability and Traffic Signing March 21 - Ankeny, March 22 - Fort Dodge This workshop introduces maintenance personnel to the proper use, placement, and maintenance of traffic control signs. The workshop covers regulatory signs, warning signs, and work zone marking. Call 515/294-5642.

Management for Street and Road Maintenance Supervisors March 25 — Sioux City, March 26 — Creston Taught by Stan Ring, this workshop helps new and experienced supervisors improve their supervisory skills through use of discussion, videotapes, and role playing. Call 515/294-5642.

Local Road and Street Pavement Management March 27-28, ISU, Ames This workshop teaches participants how to use the Iowa State Pavement Management System. Call 515/294-5642.

And justice for all Appointment, promotion, admission, and programs of extension at Iowa State University are administered to all without regard to race, color, creed, sex, national origin, disability, or age. Call the Affirmative Action Office at 515/294-7612 to report discrimination.

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