

# roads bridges transit technology news

Local Transportation Information Center  
Iowa State University Engineering Extension Service

July 1987

## Disk mowers—more efficient

One time creatures only of the wheat and alfalfa field, disc mowers now are cutting a big swath in ditches and road rights-of-way throughout Iowa, and saving money through more efficient operation.

The Iowa Department of Transportation and some county maintenance crews have been using disc mowers since 1984 to cut grass and weeds along roadsides, slowly replacing the older sickle bar mowers.

Although rotary mowers initially cost about 20 percent more than sickle mowers, they cost less to operate. Gene Simmons, supervisor of the Des Moines maintenance area of the Iowa DOT, said a mower can cut about twice as much area in a day as a sickle mower, and up to three or four times as much area on flat ground.

The mowers cover more ground because they can be operated at higher speeds. Disc mowers average 15 to 20 miles an hour on flat ground while sickle mowers can be

driven only at two or three miles an hour, Simmons said.

Bradley Osborne, an equipment specialist with the Iowa DOT Office of Maintenance, said rotary mowers have a speed advantage because the mowers are equipped with four, five, or six cutting discs with two or three blades each, and the discs spin at about 3,000 rpm.

If the sickle bar mower travels too fast, it will pull up or slide over the grass rather than cutting it, Osborne said.

Because the disc mowers can be pulled faster, tractors can be operated in a higher gear, providing "more mowing on less fuel," he said. In some cases, the rotary disc mowers replaced heavy rotary gang mowers and reduced fuel consumption just by lightening the work load on the tractor.

Disc mowers also require less maintenance because each disc has two blades with two cutting edges. When they become dull, the blades can be discarded or reversed to do "double duty," Simmons said.

Del Jespersen, the Story County engineer in Nevada, said the rotary disc mowers can be maintained at about one-tenth the cost to maintain a sickle bar mower because more labor is required to replace or sharpen sickle sections.

The disc mowers also improve cutting. "They cut so well you can't even tell it's been cut," Simmons said. In heavy grass, sickle mowers tend to plug up, so operators must back out and lift the bar to clear it. Debris from disc mowers slides over the top of the bar and falls in swaths behind the mower.

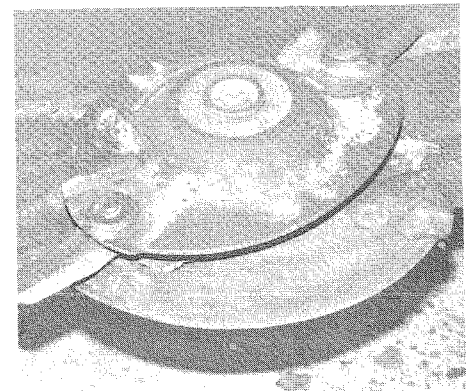
The disc mowers are hooked to the tractors by a three point hitch with a spring-loaded trip, Simmons said. If the cutter bar strikes a solid object, it swings out parallel behind the tractor. Usually the bar rides over smaller objects, and they are equipped with protective canvas covers to stop most flying objects.

Osborne said the Iowa DOT now has 69 disc mowers distributed statewide, with 11 purchased in 1984, 25 acquired in 1985 and 33 bought in 1986. The DOT has requested 26 additional disc mowers.

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Close-up view of the disc

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The five-disc mowers are usually pulled by a 45 hp tractor and 52 to 72 hp tractors are used with six-disc mowers. Osborne said horsepower is not a problem with the mowers and smaller tractors could be used, except a heavier tractor is needed to prevent the front of the tractor from lifting off the ground when mowing on slopes and in ditches.

Osborne said the DOT also adds wheel weights to the left rear tire and a suitcase type weight to the front of the tractor to increase stability on uneven surfaces.

Simmons, who has two mowers at the DOT office in Des Moines, said users like the rotary disc mowers. His department even has received inquiries from the Iowa Department

of Natural Resources, which is interested in using the mowers to clear bike trails.

"I think this is going to be the thing of the future in all the departments," he said.

Jespersen, of Nevada, said each year his crews make three passes with the mowers on each side of 190 miles of paved roads, plus one pass on each side of 728 miles of gravel roads. The tractors use less fuel per mile, and crews can cover the area in one-fourth to one-fifth the time they used to.

"These are the things we've been wanting for a long time," he said. "I can't see us using the sickle mowers again."

## DOT roadside management—more than just pretty

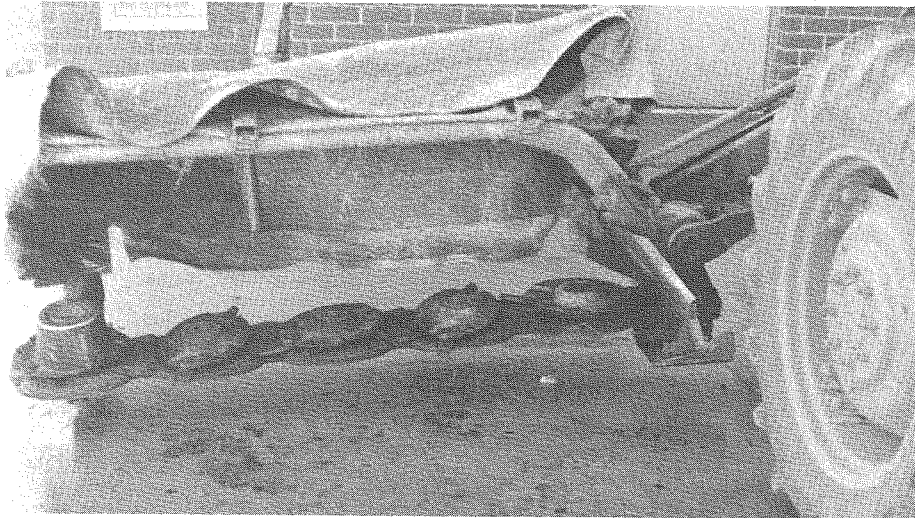
While many motorists may think the Iowa Department of Transportation's program of seeding roadsides and roadside management is just a way to make roadsides look nice, the DOT program actually combines the three practical goals of increasing motoring safety, beautifying roadsides, and conserving the soil.

Roadsides dug up by highway construction or accidents are reseeded to reduce erosion potential and provide a filter for reducing the amount of silt that runs into and eventually blocks streams. In a three-year period ending this June, the DOT will have reseeded and fertilized almost 5,000 acres.

To restore some of Iowa's vanishing prairie heritage, about 250 acres were planted with native prairie grasses, which choke out weeds and help reduce the need for roadside spraying or other weed control measures. Native flowering plants add splashes of color and natural beauty to highways, as does the 500 acres seeded with purple-and-white crown vetch. This variety helps control erosion and fixes nitrogen from the atmosphere and returns it to the soil, contributing to soil fertility.

The DOT does more than just seed. From 1982 through 1986 the department planted nearly 112,000 trees, shrubs, and vines along Iowa highways. These woody plants provide safety benefits by marking changes and dangers in the highway ahead such as curves, bridges, and culverts. Trees and shrubs also cut headlight glare and provide the visual relief necessary to reduce "highway hypnosis." Another safety factor trees and shrubs provide is controlling blowing and drifting snow.

The plantings also are a source of environmental benefits. They reduce noise, trap dust, and strip pollutants from the air, plus furnish shelter and food for wildlife.



Front view of the disc mower

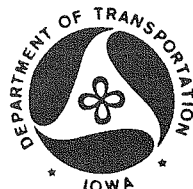
Technology News is published by the Local Transportation Information Center Engineering Extension Service Haber Road Iowa State University Ames, Iowa 50011 Program Manager—Stan Ring Coordinator—John Moody Editor—Mary Holz-Clause Editorial Assistant—Julie Anderson Barbara Hohbach

## Fewer flat tires

According to a study conducted in Dane County Wisconsin, they have found that there are fewer flat tires with the disc mower." According to Ron Evert, shop superintendent for Dane County, "We're not sure why, but we think it's because the tractor is driving on a mat of grass. Also, these blades will shred plastic and other refuse along the road that would wrap up in the other type of mower."



U.S. Department of Transportation  
Federal Highway Administration



## New signing regulations to help communities lure tourism

Iowa's roadsides could be bustling this summer thanks to the efforts of the Iowa Department of Transportation and the state legislature. To foster the local tourist industry, they have relaxed rules regulating tourist and private directional signing.

"Although the new rules have yet to undergo final legislative review, they are expected to pass without difficulty," said Steven Westvold of the DOT's Office of Right-of-Way. "We anticipate the rules will have final approval by July 8, and are taking applications now."

The new tourist-oriented signing program pertains to official signing located within the right-of-way of a primary highway (rather than an interstate or freeway) that gives specific information about activities or sites of significant interest to the travelers. These activities or sites include: motorist services (gas, food, lodging, repair), tourist attractions (historic, cultural, scientific, educational, religious, scenic, or outdoor recreation), and activities of commercial interest.

Such eligible sites, which cannot be visible from the primary highway, must be located in a rural area or inside the corporate limits of a city with a population of less than 1,500, outside the corporate limits of a city with a population between 1,500 and 5,000, or outside the urban area of a city with a population of 5,000 or more. (Several additional requirements regarding hours of operation and number of visitors are stipulated in the new regulations. These details may be obtained from the address listed below.)

The private directional signing program applies to signs erected on private property visible from an interstate, freeway primary, or primary highway. Such signs provide directional information about: public

places owned or operated by federal, state, or local governments; publicly or privately owned natural phenomena or historical, cultural, scientific, educational, or religious sites; or publicly or privately owned areas of outdoor recreation or natural scenic beauty.

The size, location, spacing, design, and content requirements for the private directional signs are specific. The signs, which must be rectangular in shape, cannot be larger than 150 square feet in area, 20 feet in height, or 20 feet in length. They must be located off the highway right-of-way; at least one mile apart; and a minimum of 2,000 feet from a public rest area, park, or interchange. The message can contain only the identification of the site, travel distance and directions, and information about time of operation. There can be no moving parts, illustrations, photographs, or advertisements on these signs. (For complete details about additional requirements, contact the office listed below.)

According to Westvold, applications for both tourist and private directional signs will be made to the DOT and forwarded for approval to a committee of representatives from the DOT, Department of Economic Development, the Department of Agriculture and Land Stewardship, and the Iowa Travel Council. "It's hard to tell at this point how long the review process will take, but we estimate it at about three weeks," he said. "The DOT will administer the signing programs and we'll work with applicants to help them design signs that will be approved."

The application forms and a brochure detailing all requirements are available from Steven Westvold, Beautification Administrator, Office of Right-of-Way, Iowa DOT, 800 Lincoln Way, Ames, Iowa 50010.

## Call for papers

The Transportation Research Board is continuing a series of fact sheets of recent developments, research, good practices, and technical assistance materials in the field of Small Urban Area Planning. If you have any material concerning this subject, we would like to encourage you to submit it to:

James A. Scott  
Transportation Planner  
Transportation Research Board  
2101 Constitution Ave. N.W.  
Washington, D.C. 20418

## New tips for the field series available

A new series featuring 20 tips from the field is available from the Local Transportation Information Center. To request a copy of the free publication contact John Moody, EES Building, Haber Road, Iowa State University, Ames, Iowa 50011. The phone number is (515) 294-8818. There are also copies of the first and second series of tips available.

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### And justice for all

Appointment, promotion, admission, and programs of University Extension at Iowa State University are administered equally 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.

## Noise walls—Do they work?

By J. Kirby Lidman, Iowa Department of Transportation, Ames

### Effect of a Noise Wall on Snow Accumulation and Air Quality

In response to concerns expressed by residents near highways that noise walls would trap air pollutants and cause snow accumulation, J. Kirby Lidman of the Iowa DOT Transportation Research Board studied a noise wall installed on I-235 in Des Moines, Iowa.

Lidman said he gathered data from the site using environmental monitors both before the wall was in place and after it was installed during 1979-80. A wind tunnel study also was done with a model of the wall. Field measurements and observations were made for carbon monoxide and wind factors.

The 1,055-meter long wall was on a north-south section of the highway and varied from four to five meters in height. The solid wall was composed of interlocking steel panels. The adjacent area was residential, with back yards extending to the wall and containing considerable vegetation.

Wind tunnel tests subjected the model wall to wind velocities corresponding to 33 and 24 mph normal to the wall. The approach to the model wall was left as a flat plane with no model city or vegetation used. Nearly all snow accumulations were deposited on the windward (upwind) side of the wall, which Lidman said is typical of a wall without a bottom gap. Eventually the space to the windward drifted full to a drift length (normal to the wall) of 10 times the fence height.

Once the windward side has drifted full, another drift will start to form on the leeward side, also to a length of 10 times the height of the fence. Lidman said the experiments were

not carried far enough for the full development of the leeward drift. Results for the two wind velocities were essentially the same for a long storm.

Lidman found that in the field, buildings and vegetation caused a certain amount of terrain roughness that decreases the amount of snow accumulation, and accumulations have not been a problem in the four years since the wall was constructed.

Apparently turbulence caused by the terrain roughness and passing vehicles have prevented any substantial drifting. The wind tunnel results should probably be considered a conservative baseline estimate of what could be possible under extreme conditions, according to Lidman.

Under certain conditions, entrapment of certain pollutants are possible near a wall, which Lidman said was a citizen concern. This effect was studied by introducing smoke into the wind tunnel with the model wall in place. Air quality at the actual site before and after construction also was monitored, and Lidman said ". . . in most situations (the wall) really didn't have much effect . . ." on the amounts of pollutants trapped and detected.

Some mixed results were noted, however. When crosswinds fell below a certain level, the carbon monoxide levels were lower when the wall was in place, but as the crosswinds were increased the carbon monoxide levels were higher with the wall in place.

Lidman said the noise wall ". . . did have a significant effect on particulate matter . . . and kept particulates from getting over onto the resident side of the wall."

## Employees' driving records affect their insurability

Condensed from an article by Jack A. Lipovac  
Personnel and Labor Relations Consultant

**Industries Council, Des Moines**  
Insurance companies have recently begun refusing to insure employees who have poor driving records. This policy is particularly a problem for local governments whose employees must drive publicly owned vehicles. In the last two years, a number of local governments have been faced with special provisions written into insurance policies excluding one or two of its employees. The local government is then left in a precarious position.

Does the local government allow an employee to drive a motor vehicle without insurance and thus become a self-insurer? Do they find another position for that employee or do they terminate the employee? How can a public agency supported by tax dollars risk thousands or millions of dollars of taxpayers' money to operate motor vehicles after the insurance company has refused to insure the driver because of his or her poor driving record?

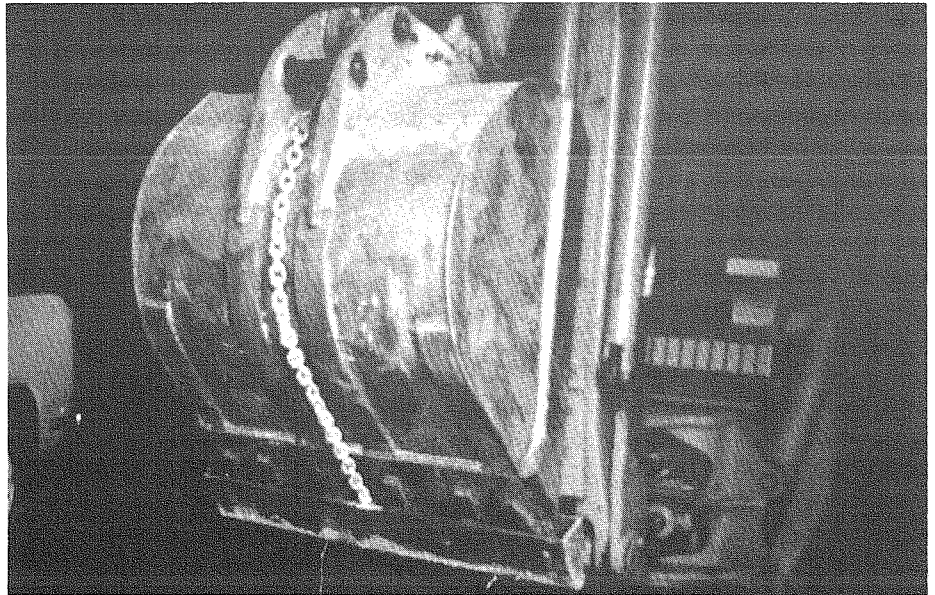
The problem in this particular situation is that logic does not always control. In this age of increased litigation, employees who have been terminated for their lack of insurability have successfully filed suits through various governmental agencies and union contracts. The usual remedy has been reinstatement, back pay, and punitive damages.

In Iowa, I have represented four different public employers in this particular type of situation. We have been successful in the hearings. However, it is important that local government be prepared for more litigation in this area. Insurance companies are refusing coverage for employees who have been involved

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Certain backhoe projects such as restoration and ditch bottom cleaning call for a neater smooth surface finish instead of gouges and backhoe teeth scars. Therefore, the Ames Water Department has built a simple slip-on sheath to cover backhoe teeth.

The sheath can be slipped on or off the teeth with a single chain and bolt device, with the chain attached to the sheath and running along the center underside of the bucket. To hook the other end of the chain to the bucket, a bolt is welded to the chain and dropped through a hole drilled in the bucket's swivel pin.



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## Unnecessary steps can save fuel and reduce pollution

In an effort to reduce fuel consumption and pollution, the Iowa Department of Transportation has plans to improve the traffic flow in several cities throughout the state.

DOT officials noted a typical passenger car averaging 35 mph in an urban area will use 29 percent less fuel than one traveling at an average speed of 25 mph. In addition to saving fuel and reducing wear on vehicles because of stopping, starting, and idling, that same 10 mph increase in speed reduces carbon monoxide emissions from the car by 34 percent.

Key factors in the efficient movement of motor vehicles in cities are the traffic control devices, including traffic signals. All traffic signals in Iowa, including those on state highways, are maintained and operated by local cities. There are variations in the operation of traffic control devices from city to city, and traffic does not always flow as smoothly as it would if more up-to-date equipment and procedures were being used.

To alleviate this situation, a new Iowa DOT program will assist Iowa cities in updating their traffic control systems. Funding for this project is coming from federal money earmarked for motor vehicle fuel reduction programs.

The DOT has selected 21 cities from proposals submitted by cities wishing to participate in the \$3 million demonstration program. Geographic distribution, population, current traffic signal technology in the cities, potential reduction in fuel usage, individual attributes of the cities' proposals, and sharing of the project costs by the cities were used as criteria in the selections.

The agency has allocated money to Algona, Ames, Atlantic, Bettendorf, Council Bluffs, Decorah, Des Moines, Harlan, Indianola, Iowa City, Knoxville, Mason City, Monticello, Muscatine, Sioux City, Spencer, Storm Lake, Urbandale, Waterloo, Webster City, and West Des Moines.

Before the changes have been completed, savings will be predicted by computer and verified after changes are made. The computer estimates the amount of fuel used while a

vehicle idles, and the additional fuel used in starting and stopping before and after the changes have been made.

Noise pollution can also be reduced by changing traffic signals. Trucks emit exhaust noise of more than 90 decibels when accelerating from a stop, so if the number of stops is reduced the noise level would drop.

As part of the demonstration program, the DOT will develop instructional materials such as videotapes, technical training papers, case study brochures, and other materials to help local traffic managers determine the proper procedures for handling traffic, and to inform the public about how the programs can save them time and money.

The federal funds to be used by the Iowa DOT in this program come from a U.S. court case against several oil companies that had violated federal petroleum pricing regulations. The money paid by the oil companies as a result of the court case is being distributed to the states by the federal government for programs to benefit fuel users.

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in accidents, picked up for various traffic violations or charged with operating a motor vehicle while intoxicated.

If a local government is faced with a situation of terminating an employee for losing insurability, it can expect the following arguments from the employee's representative during the termination hearings.

First, the employee has had no prior warnings regarding his driving record. In most cases, the employer had no idea the employee received a ticket or had been involved in an accident.

Second, the employer has no rule or qualification requirement regarding insurability.

Third, the employee was never told that continued insurability was a condition of employment. To support this argument, they will point to the employee job descriptions, the employee handbook, and the rules and regulations developed by the county.

If a union is representing a discharged employee, it will also make the argument that the insurance company is not a party to the collective bargaining agreement and has no legal or contractual right to determine whether or not an employee will continue his or her employment with the county.

In order for the employer's position to be upheld, the employer must demonstrate the following things.

First, the employer did not solicit the insurance carrier to deny that employee's insurance. In other words, the employer was not out to "get" the employee.

Second, the county must show that it made an independent investigation of the employee's driving record. The county should not rely solely on the insurance company's statement.

Rather, the county should review the employee's driving record to make sure the insurance company was not in error. This step is extremely important. One of the employers that I work with had 16 employees lose their insurability. An independent investigation showed that six of the employees' driving records—records on which the insurance company had relied—were in error. If the employer had not done the investigation, he could have been held liable for back pay for those six employees.

Third, the county must show that it made a good faith effort to find alternative insurance coverage. In one case, the employer contacted 17 insurance companies and a number of insurance agents requested by the union in an attempt to find alternative coverage. This action showed a good faith effort on the part of the employer to find another insurer.

Fourth, the employer must attempt to find other work in the county for these employees. In one case, the employer offered the terminated employee another position at a lower pay rate. The employee refused the offer. The arbitrator in that case upheld the employer's discharge, noting that the employer had offered the employee another position.

If the employee decides not to file any litigation regarding his or her termination, the next question is whether or not the employee can collect unemployment compensation. The Iowa Supreme Court, in *Tim D. Cook v. Iowa Department of Job Service*, ruled that losing one's insurability constitutes misconduct as defined in the Iowa Code.

In this case, a trucking company was informed by its insurance company that they would no longer insure an employee due to his driving record. After attempting to change the insurer's mind, the company informed the employee that he could no longer drive for them. The employee filed for unemployment. Job Service denied his claim based on the fact that losing one's insurability was considered misconduct under the Iowa Code. The employee appealed to the Iowa Supreme Court. The court ruled that since the employee was a truck driver, his repeated violations rendered him uninsurable and thus unemployable. While he received most of his driving citations during nonwork hours in his personal car, the violations bore directly on his ability to work for the employer. The court went on to note that the employee knew he was violating laws of the road yet persisted in doing so.

To avoid problems in the future, the county should develop employee work rules that clearly state that an employee must have a good driving record and remain insurable. These work rules should also state that their driving record is looked at for traffic violations and accidents on and off the job.

The employer should develop job descriptions stating very clearly that a good driving record and insurability are requirements for the job. These rule changes should be sent to all employees so that everyone is aware of them. Each year the county should check employee driving records to make sure employees do not have any traffic violations and/or accidents on their records that could endanger their insurability.

# The ball-bank indicator and liability

R. L. Carstens, professor emeritus of civil engineering, Iowa State University

This column has previously made reference to the use of a ball-bank indicator in helping to establish recommended speeds for curves. Some readers have requested further information on how to conduct and interpret a ball-bank indicator test for this purpose.

The procedure for conducting ball-bank indicator trial runs is described in the *Traffic Control Devices Handbook* on page 2-22 through 2-25. This reference suggests that the device first be mounted in a car and set at zero when the car is level and loaded as it will be during test runs. Trial runs should be made starting at a speed below the anticipated recommended speed. Successive runs are made at faster speeds in 5 mph increments until the desired deflection is equalled or exceeded. The vehicle path should parallel the roadway centerline while the ball-bank indicator is being read.

The *Handbook* suggests a maximum 14° deflection for recommended speeds of 15 mph or below, 12° for speeds of 20 mph to 30 mph, and 10° if the recommended speed is to be 35 mph or greater. Figure 2-7, reproduced from the *Traffic Control Device Handbook*, shows a 15° reading. This indicates that the speed at which the reading occurred is faster than an appropriate recommended speed for that curve.

Trial runs normally are made in both directions. The recommended speed for the curve commonly would be the lowest of the two readings, if they differ, and would be displayed for both directions of travel.

In this writer's experience, ball-bank indicator readings will fluctuate rather widely during a trial run. For example, deflections recorded during two trial runs in the same direction at 35 mph fluctuated between 8° and 13°. Deflections in the reverse direction on this 404 ft.

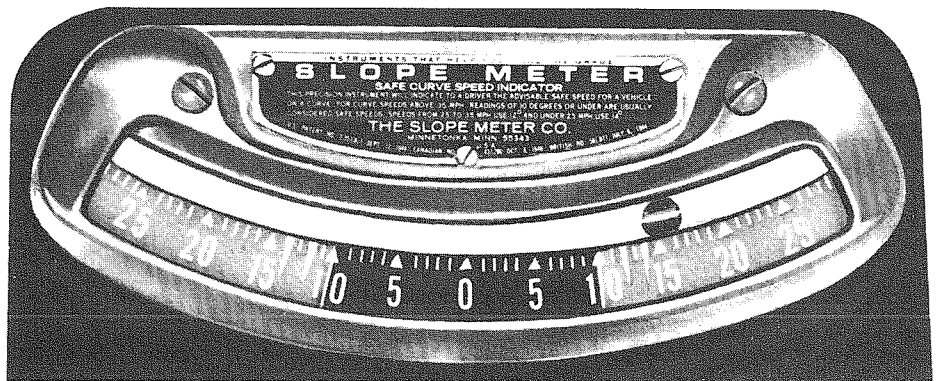
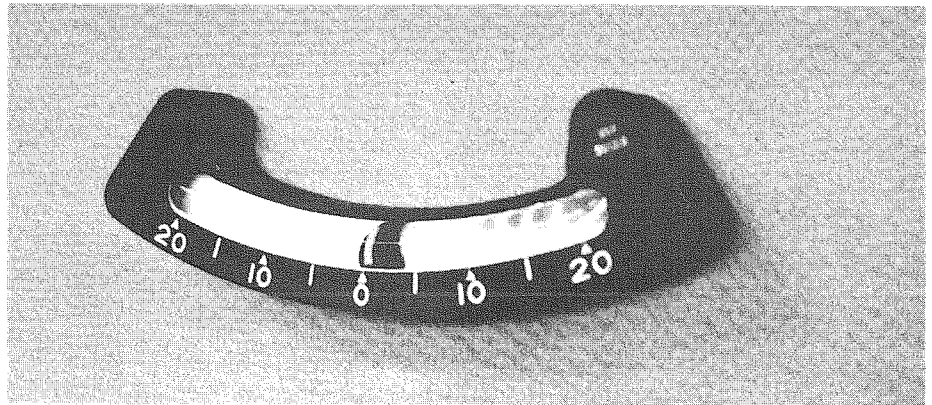
radius curve varied from 8° to 15°. A greater range has been observed on rough loose-surfaced roads. Conclusions must be based on the deflection occurring most frequently as judged by the observer.

It also has been pointed out previously that readings can vary substantially as a function of the vehicle suspension system. Up to 5° difference has been observed. For example, a deflection of 13° in a vehicle with a very soft suspension system can result from trial runs on the same curve that will show an 8° deflection on a ball-bank indicator mounted in a vehicle with a harsh suspension.

So, as is generally the case, the selection of a recommended speed still depends to a significant extent on the judgment and experience of

the person responsible for sign installation. The recommended speed should feel comfortable and be much lower than a maximum safe speed. Recommended speeds should also be sensible in comparison with prevailing speeds. An existing installation having a 25 mph speed advisory does not make much sense to this observer where the fifteenth percentile speed is 27 mph and the median speed is 31.5 mph.

Following these suggestions regarding use of a ball-bank indicator will not solve all of your liability problems. Nothing else will, either. However, proper use of a ball-bank indicator and suitable documentation should be helpful in the defense of a number of court cases involving curves. Hopefully, it might also prevent an accident or two.



The ball-bank indicator

# The Fourth International Conference on Low-Volume Roads, August 16-20

The Fourth International Conference on Low-Volume Roads will be held August 16-20 on the Cornell University Campus in Ithaca, New York. The conference, held once every four years, will provide professional engineers at the county and city level a forum for information exchange on state-of-the-art secondary road engineering.

The registration fee is \$100 for the first person from a firm or agency and \$75 for subsequent registrations. For more information contact: Fourth International Conference on Low-Volume Roads, Transportation Research Board, 2101 Constitution Avenue, NW, Washington, D.C. 20418.

## conference 1 2 3calendar

**APWA—Iowa Chapter Annual Meeting**  
Gateway Holiday Inn, Ames, Iowa  
August 13-14, 1987

**International Public Transit Expo**  
San Francisco, California  
September 28-30, 1987  
More than 360 suppliers will showcase their newest and best equipment, products, and services.

**American Public Transit Association Annual Meeting**  
San Francisco, California  
September 27-October 1, 1987  
The American Public Transit Association is the North American organization representing the urban transit industry. Its members include nearly 850 motor bus and rapid transit systems, along with the organizations responsible for planning, designing, constructing, financing and operating transit systems.

**International Public Works Congress and Equipment Show**  
Chicago, Illinois  
September 19-23, 1987  
This is North America's largest display of public works equipment with more than 400 exhibitors and close to 10,000 public works individuals.

**International Pavement Maintenance/Management Technology Symposium**  
Chicago, Illinois  
September 23-25, 1987

More than 55 individual presentations will cover all aspects of the current state-of-the-art in 4R management and decisions.

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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, to local and county highway and transportation personnel.

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.

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Address correction requested.  
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