Technology for Alaskan Transportation

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University of Alaska Fairbanks
Transportation Technology Transfer Program

In This Issue

Controlling Roadway Ice
Computer-Aided Design
Reducing Salt Use
Bridge Posting

This newsletter is sponsored by the University of Alaska Fairbanks and the Alaska Department of Transportation and Public Facilities

Controlling Roadway Ice

Ice on roadway surfaces creates a safety problem for drivers everywhere in Alaska, especially in urban areas with a high volume of traffic, where stop-and-go driving is common. Traditional methods of ice control are expensive, and each method has disadvantages.

There are two ways to approach the problem. Apply anti-icing materials to the ice. Or incorporate anti-icing materials in the pavement when the roadway is built.

Sand and salt are commonly applied to icy roads. Sand provides only temporary skid resistance. Stopping distances on sanded ice are also much greater than on dry pavement.

Traffic action quickly removes sand, so it must be reapplied often. In addition, sand must be removed from gutters and inlets in urban areas following spring thawing to avoid blockage of drainage systems.

Using salt to remove roadway ice saves travel time and reduces accidents, but may cost the road user more than 10 times as much as the sum of the benefits. The major cost of using salt is the corrosion of vehicles and bridges, which shortens their useful lives. Salt in roadway runoff also can contaminate groundwaters and surface waters. One way to reduce the environmental impact of salt is to incorporate salt particles in the pavement itself.

Potential environmental problems of salt runoff can be eliminated completely if large rubber particles are incorporated into the pavement.

A paving system was developed in Sweden 20 years ago which incorporated rubber particles (from 1/16 to 3/8 inches in size) into asphalt pavement. The rubber-modified pavement is a more flexible surface, so that traffic breaks and knocks aside ice on the roadway. This effect is caused by the flexing of protruding rubber particles. Rubber-modified pavement increases both skid resistance and durability.

This system is distributed under the trade names "Skega Asphalt" or "Rubit" in Scandinavia and "PlusRide" in the United States.

But will the Swedish system work in Alaska? To answer this question, the Alaska Department of Transportation and Public Facilities (DOT&PF) installed experimental pavement sections in Juneau, Anchorage and Fairbanks using the PlusRide system.

The system does work to some extent. Rubber-modified pavement in Alaska had the ability to shed an ice cover more quickly than conventional pavements. Furthermore, the pavement was more flexible and fatigue

(continued on page 2)

Bridge Posting

Federal Highway Administrator, A.A. Barnhart, has asked that we convey to our readers the importance of posting load-restricted bridges. A recurring problem and continuing concern of the Federal Highway Administration has been bridge safety, which involves the need to post load-restricted bridges as well as proper maintenance.

Bridge safety is a subject deserving special attention. These problems are directly re-

(continued on page 3)

Controlling Roadway Ice

(continued from page 1)

resistant, and it reduced tire noise. Under Alaskan conditions of icy nonsalted roadways, stopping distances were consistently reduced on rubber-modified asphalt pavements, averaging 20-25 percent less than normal pavements.

An interesting spinoff of using PlusRide pavement is that the rubber-modified pavement provides a beneficial use for what is normally a troublesome waste product: used tires.

The U.S. Congress recognized this in 1984, when it increased federal funding by 5 percent for highway projects with pavements using rubber. If all 230 million tires discarded annually in the United States could be used for rubberized pavement, they would provide enough for 600,000 lane-miles each year.

Though effective and environmentally benign, the PlusRide system is not a perfect solution to the icy roadway problem. Rubberized asphalt is most effective in higher traffic, higher speed areas; slow, light traffic does not produce enough flexing action to loosen ice.

The Alaskan pavements incorporating rubber granules appear to have superior resistance to fatigue cracking, but they are somewhat more susceptible to raveling and potholing than normal asphalt. Keeping field void levels at less than 8 percent by proper mix design, preparation and compaction is critical for raveling resistance. Rubber-modified pavement should not be placed directly on unbound gravel bases, but rather used as a thin overlay on a conventional pavement.

Overall, however, the use of coarse rubber particles in asphalt paving offers significant advantages when the pavement is properly placed and used in the proper location. This is particularly true for areas such as bridge decks or insulated sections of roadways, where surface temperature differences may lead to differential surface icing.

If you would like to learn more about rubber-modified pavements, your local library should have a copy of a report by David C. Esch entitled *Asphalt Pavements Modified With Coarse Rubber Particles*. This 49-page report is also available from Publications, Transportation Technology Transfer Program, University of Alaska-Fairbanks, Fairbanks, AK 99775-1760. Request DOT&PF Report FHWA-AK-RD-85-07. We can also provide a four-page draft manuscript on subsequent research. AT

News & Views

Reducing the Use of Salt on Roads

A recent study, performed for the Alaska Department of Transportation and Public Facilities, attempted to quantify salt-related damage to vehicle and bridge decks in the Anchorage area, and it examined how to reduce the use of salt. In addition to corrosion, negative effects of salt include flaking or crumbling of concrete, stunted growth of roadside vegetation and potential health problems from increased chloride levels in water supplies. Using a simple economic analysis documented in the report, corrosion damage to vehicles in Anchorage was estimated at $5.1 million per year, and repair of corroded bridge decks was estimated at $68,000 per year.

Salt use can be reduced by storing sand in heated buildings, by formulating specific application rates for chemicals, by calibrating distribution equipment, and by making policy decisions regarding winter road maintenance and continued research into the use of alternative chemicals. Storing sand in heated buildings and using noncorrosive chemicals like urea or calcium magnesium acetate were singled out as particularly promising for Anchorage. The document is particularly relevant to highway departments in northern cities and states, and to any agency responsible for snow control.

Single copies of this 39-page report are available to state and local officials at no charge from Publications, Transportation Technology Transfer Program, University of Alaska-Fairbanks, Fairbanks, AK 99775-1760. Request *Costs to the Public Due to the Use of Corrosive Deicing Chemicals, and a Comparison to Alternative Winter Road Maintenance Procedures.*

The Use of Computer-Aided Design Techniques in Highway Engineering

This report summarizes the results of a project undertaken by the Roads and Transportation Association of Canada to determine the availability of computer-aided design and drafting (CADD) systems in Canada and how they are being used. Based on surveys of CADD system vendors and users, 15 systems are assessed in terms of various factors, including cost, capabilities and use. The report also focuses on the interchangeability of interactive computer graphics, hardware and software, and it provides guidelines for compatibility among systems.

This publication is available for $24.00 from the Roads and Transportation Association of Canada, 1765 St. Laurent Blvd., Ottawa, Ontario, Canada K1G 3V4.

Handbook of Road Technology

All aspects of urban and rural road technology are presented in this two-volume reference. Volume 1 contains a description of the procedures involved in the construction of roads, from planning policies and design considerations to the selection of materials. Volume 2 provides insights into road operating environments such as driver behavior, traffic flow, lighting and maintenance. The costs, economics and environmental impact of road use are assessed.

The *Handbook of Road Technology* was written by M.G. Lay, of the Australian Road Research Board. The two-volume set costs $120, and can be purchased through D.A. Book (Aust) Ptg Ltd., 11-13 Station St., Mitcham, Victoria, Australia 3132.

Bridge Posting

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lated to tort liability as well as highway law in general. Over 37 percent of bridges were built before 1941, and they are approaching or have exceeded their useful life, which is estimated to be 50 years.

About one out of four bridges in the federal-aid highway system has been identified as deficient by FHWA.

A bridge is considered structurally deficient if either its deck, superstructure or substructure has weakened or deteriorated to the point that the bridge is inadequate to support all types of traffic. Poor design and construction, general wear and lack of proper maintenance are major causes of structural deficiencies.

Local officials are urged to ensure that the bridges are posted. Posting these bridges is in the best interest of local governments.

Under-strength bridges are a safety risk to motorists and a liability hazard to the government responsible for maintaining them. At a minimum, motorists must have the information they need to decide whether to drive across an under-strength bridge.

The courts have held that the state may owe a duty of care to users of state highway bridges in a wide variety of situations. Tort liability for design, construction and maintenance defects in highway bridges and bridge railings is governed by the same general principles applicable to defects in other highway components.

Courts have stated that the state's general duty to maintain highways in reasonably safe condition for the traveling public applies to bridges in cases involving defective warning devices, guard rails, road surfaces and other features common to highways and bridges.

Thus, highway agencies charged with the duty of safeguarding public safety must use cost-effective methods—including posting—to meet this obligation. AT

News & Views continued

Paying for Growth: Using Development Fees to Finance New Infrastructure

Impact or development fees are being used increasingly by communities to raise funds to pay for improvements to roads, sewer and water systems, parks and other public facilities.

Traditionally, one generation of residents benefits from the infrastructure investment of previous generations; only in communities growing more rapidly than the inflation rate are special fees on new development warranted, according to this report published by the Urban Land Institute.

This publication contains an analysis of the types of private financing required for expansion of infrastructure systems, the legal foundation for public requirements, economic effects of these requirements and the administrative procedures necessary to carry out the imposition of development fees.

This report is available for $42.00 from the Urban Land Institute, 1090 Vermont Ave., N.W., Washington, DC 20005.

Continuing Education

Backcalculation Procedures

We conducted a short course on August 27-28 that provided an introduction to backcalculation procedures for determining layer strength. The procedures were all based on matching a measured deflection or reflection basin with calculated values.

The instructors discussed several methods and demonstrated the use of three computer programs; BISDEF, ELSDEF and MODCOMII. The course was taught by Dr. Gary Hicks of the Transportation Research Institute (Oregon State University) and by Dr. Nicolaas Coetzee of the University of Alaska Transportation Center. The instructors required that participants had an understanding of linear elastic theory as applied to roadway and airfield embankments.

While a modest course fee was charged, the major portion of the cost of the course was borne by the Transportation Technology Transfer Program.

About Our Newsletter

Technology for Alaskan Transportation is a quarterly newsletter that informs local transportation people in government and industry of useful publications and services. The newsletter reports on useful research findings, new technology, and learning opportunities such as workshops, seminars and video tapes. To get on our mailing list or to contribute to the newsletter, contact:

Editor
Transportation Technology Transfer Program
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(907) 474-6116

About Our Program

The goal of the Transportation Technology Transfer Program is to help local agencies obtain useful information and training related to local transportation needs. The program focuses on technology related to roads, bridges and public transportation. In addition to our newsletter, we will provide low-cost seminars and workshops, provide copies of useful technical reports upon request, and answer phone and mail inquiries related to transportation technology. If we don't have the answer, we will refer the question to a suitable specialist.

A variety of organizations support the Transportation Technology Transfer Program:

- ☐ the University of Alaska Transportation Center (UATC is an interdisciplinary center with participation from the schools of Engineering, Mineral Engineering, Management, and Agriculture and Land Resources Management).
- ☐ the Alaska Department of Transportation and Public Facilities
- ☐ the Federal Highway Administration

We invite you to address your questions or comments to any of the following people:

John D. Martin, P.E.
Chief of Planning and Research
Alaska Department of Transportation and Public Facilities
2301 Peger Road
Fairbanks, Alaska 99709-6394
(907) 451-5150

Dr. Jan Botha
University of Alaska Transportation Center
University of Alaska Fairbanks
Fairbanks, Alaska 99775-0660
(907) 474-7497

Dr. Nick Coetzee
Director
University of Alaska Transportation Center
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Fairbanks, Alaska 99775-0660
(907) 474-6124

Calendar of Events

We will be happy to include any relevant event you would like to publicize. Call the editor at (907) 474-6116. For information about events in Alaska, call John D. Martin at (907) 451-5150 or Dr. Jan Botha at (907) 474-7497.

1987

***November 2-6*—Second North American Conference on Managing Pavements.** Toronto, Canada. Contact Angelia Arrington at (202) 334-2934.

***November 16-18*—Highway Applications of Microcomputers.** Austin, Texas. Contact Texas Engineering Extension Service at (409) 845-2913.

***November 19-20*—AAAE Management Information Systems/Computer Seminar.** Dallas, Texas. Contact AAAE at (703) 825-0500.

***December 9-11*—AAAE Strategic Planning/Legislative Seminar.** Palm Springs, California. Contact AAAE at (703) 825-0500.

***Winter*—Conference on State and Local Issues in Transportation of Hazardous Materials.** Site to be determined. Contact Angelia Arrington at (202) 334-2934.

1988

***January 11-15*—67th Annual Meeting of the Transportation Research Board.** Washington, DC. Contact Angelia Arrington at (202) 334-2934.

***June 1-5*—2nd International Conference on Case Histories in Geotechnical Engineering.** St. Louis, Missouri. Contact Angelia Arrington at (202) 334-2934.

***June 8-9*—1st International Symposium on Surface Characteristics.** State College, Pennsylvania. Contact Angelia Arrington at (202) 334-2934.

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PROGRAM EVALUATION

With the completion of 15 months of the Technology Transfer Program, the Alaska Transportation Technology Transfer Program is beginning an evaluation to determine the effectiveness of the program. Please take a few minutes to fill out this confidential questionnaire; your HELP is essential to us. We appreciate your concern and thank you in advance.

1. How many of the following items have you received (or attended) to date and how helpful are they?

	Number	Helpful	Some help	No help
★ Newsletter	_____	_____	_____	_____
★ Publications	_____	_____	_____	_____
★ Training Course	_____	_____	_____	_____
★ Write or call the Center	_____	_____	_____	_____

2. Has any technique or information that you have learned, or materials obtained from the program made your job less costly, safer or more efficient?

_____ Yes _____ No

If yes, please state specifically what it is, how it helps you and how much it results in cost saving.

What _____

_____

How _____

_____

How much _____

_____

(add additional sheets if necessary)

3. How long did it take for the program to respond to your request?

_____ 1 week _____ 2 weeks _____ 1 month _____ more than 1 month

4. Do you have a suggestion for improving this service?

_____ Yes _____ No

Please explain _____

_____

_____

5. Which of the following best describes your employer?

_____ City / Municipality

_____ Borough Government

_____ State Government

_____ Federal Government

_____ Academic Organization

_____ Consulting Service

_____ Others

(please state what) _____

6. Please state your location?

_____ State

_____ City / Borough

COMMENTS: _____

_____

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_____

We would be very pleased to hear from you at any time. If you have any comments to make, wish to correct or change your address, or give us the names and addresses of others who might wish to receive this newsletter, please make use of this free mailing form.

Please add to your mailing list:

_____

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Please change my address to:

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Tips for Reducing Tort Liability

Number 3, 1987

Tort liability is a growing concern in states throughout the country. Alaska is no exception. Although local tort problems differ, there are basic precautions that can be used in any location. The following report from the Pennsylvania Department of Transportation (PennDOT) outlines some of these precautions.

When the Commonwealth of Pennsylvania lost legal protection from liability suits (its Supreme Court declared the state's "sovereign immunity" status unconstitutional) and citizens began bringing claims against the PennDOT, the transportation department wanted to know how to better protect itself.

To find out how to reduce tort liability claims, PennDOT analyzed the claims against it and concluded that approximately 75 percent related to maintenance operations. Researchers discussed specific cases with attorneys and also interviewed county maintenance managers in five counties to gain insight on planning, prioritizing and conducting maintenance operations.

This research yielded a number of recommendations to reduce exposure to suits. The strategies are discussed in a PennDOT report entitled, *Risk Management Analysis-Highway Maintenance Operations*, by Thomas E. Bryer. The following summarizes the report's recommendations.

Emergencies

Most of the emergency conditions PennDOT encounters entail knocked down stop signs and icy spots. (PennDOT does not maintain traffic signals.) Less frequent emergencies include major potholes, slides and significant water buildup on the roadway. The following are some key steps that the report recommends for reducing exposure to tort liability claims.

1. Establish a communication system which will enable police agencies to immediately contact individuals who have authority to react to the emergency.
2. Establish a process which will enable crews or individuals to quickly assemble and respond to emergency situations during nonworking hours.
3. Ensure that the individuals responsible for accepting notification during nonworking hours have enough authority to determine if the condition constitutes an emergency or can be corrected during normal work hours.
4. When an emergency condition exists, request police to control traffic at the site until the work crew arrives. Document the name of the police officer and the time of the request.

Hazards

1. Document on a standard form all complaints and notifications of hazards whether received by letter or by telephone. The form should identify the name, address and phone number of the complainant, the time the complaint was received, the person who received the complaint, and the time and type of corrective action taken.
2. In some instances, complaints cannot be addressed for an unusually long period because of other, higher priority work. When this occurs, document what work had to be done prior to the correction in question.
3. Document complaints or notifications of hazards for which another agency (municipality, contractor) has correction responsibility by recording the time the responsible agency was notified and the name of the individual who received the notification.

Low Shoulders

1. Low shoulders at isolated locations such as the bottoms of steep grades or the insides of sharp curves sometimes pose serious repetitive problems. A solution in such instances is to pave the shoulder with an all-weather surface capable of withstanding occasional loads.
2. When a major shoulder drop-off exists and cannot be corrected within a reasonable period of time, install flashing barricades or low shoulder warning signs.
3. Low shoulders pose a higher potential for accidents during winter months, and they are also more difficult to repair during the winter. Therefore, emphasize shoulder work in the fall to minimize low shoulder occurrences during the winter.

Icy Spots and Snow Removal

1. Identify specific roadway sites that ice up frequently, the probable causes for the ice and the remedial action necessary. Corrections should occur prior to winter.
2. For those locations that ice up frequently and are caused by illegal driveways or runoff from adjacent parcels of land, write the property owners about the problem. If the property owners fail to correct the problem within a reasonable period of time, contact the agency's legal counsel to pursue appropriate legal action.
3. Erect "Watch for Ice" signs near reoccurring icy spots that cannot be corrected.

Signing

1. Establish a process to routinely identify and correct sign deficiencies, including knocked down, missing and nonreflective signs, and signs that do not comply with regulations.
2. Treat knocked down stop signs as emergencies and replace them immediately. In some cases, a temporary stop sign (mounted on a tire rim or similar base) can be used until a sign crew can install a permanent sign. When notified of a knocked down stop sign, request police to remain at the site and control the intersection until the agency's crew arrives and replaces the sign.
3. Establish a process that will enable crews to identify signs which may be covered by foliage during spring and summer months, and to take preventative action.

Potholes

1. In the spring, when most potholes appear, the major repair emphasis is usually on higher traffic arterials. However, the maintenance strategy for pothole repair should be sufficiently flexible to also repair potholes on lesser priority routes if those potholes are potentially more hazardous.
2. Treat major potholes judged to have substantial accident potential as emergency conditions. Consider flashing barricades or repair during nonworking hours as probable solutions.

Construction Zones

1. A contractor should not be permitted to modify a traffic control plan without the written approval of the agency.
2. Prior to using a given route or combination of routes as a detour, the route(s) should be thoroughly inspected to ensure that all traffic control devices conform to established regulations, and that other deficiencies such as low shoulders and potentially hazardous potholes are corrected.
3. The construction contract should contain a legal clause that indemnifies the agency in the event of an accident.
4. Utility companies, municipalities and other public bodies that perform work with agency rights of way should agree by contract to indemnify the agency from any claims associated with the work performed.

Guardrail Repair

1. Establish a process to repair accident-damaged guardrails within a reasonable period of time. Immediate repairs are advisable if there is substantial potential for a serious accident.
2. Replace existing, blunt-ended guardrails damaged by accidents with standard, buried-end guardrails.

General

1. Teach maintenance personnel about reducing the potential for claims against the agency. Give them case summaries (with the specifics removed) and court verdicts so they can see the relationships between maintenance operations and tort laws.

2. Sometimes a claim is not made until months or even years after an accident. After accidents which are likely to precipitate a suit, record highway data such as pavement, shoulder and sign conditions shortly after the accident. Photographs are most reliable.

3. Reassess manuals and regulations periodically to determine if the documented criteria and requirements reflect the actual capabilities and priorities of the agency, in addition to the latest acceptable standards and techniques.

Summary

The report stresses that, although it is important to closely scrutinize maintenance functions and tort liability relations, an agency should not lose sight of its primary maintenance goals. The actions taken to reduce tort liability should complement the agency's ability to reach its maintenance goals rather than force the agency to choose between its goals and tort liability.

For More Information

For back issues of our newsletters and notes, or to get on our mailing list, write: Publications, Transportation Technology Transfer Program, University of Alaska-Fairbanks, Fairbanks, AK 99775-1760. For more information, you can also call John D. Martin, P.E., at (907) 451-5150 or Dr. Jan Botha at (907) 474-7497.

An effective winter snow control program requires year-round work and planning. To make sure your town's snow control operation is comprehensive and well planned, refer to the following checklist.

Pre-winter Planning

Plan plowing routes to bring trucks back to storage facilities when they are almost empty of deicing material. This saves time and fuel. Keep plowing routes short so they can be completed in two hours or less at a maximum speed of 25 miles per hour.

Plan to keep routes for fire and other emergency vehicles plowed at all times, no matter what the weather.

Have employees make trial runs of their routes before winter to familiarize themselves with routes, road conditions, obstacles and problem areas. Remember that road conditions change from year to year, and obstacles may be present now that were not there in the past. Plan fall meetings to familiarize road crews with their winter duties and all routes in case someone becomes ill and another crew member must take over the route.

During trial runs, pinpoint drains and waterways that must be opened after every storm. Mark other structures that will be hidden from a plow, including fire hydrants, guardrails, drop inlets, catch basins and curbing ends.

Train operators thoroughly in the use of their equipment. This will ensure that operators are more effective, and that equipment will last longer and cost less to maintain.

Mount, load and test all spreaders. Make necessary repairs to spreaders and other critical parts. Calibrate all spreaders and place a calibration card on the visor or in the compartment of each truck. Keep copies of all calibration cards on file. Make sure all personnel are familiar with spreader controls, whether automatic or manual.

Inventory and order all equipment parts in the fall so that the items will be on hand when needed. It's difficult to obtain parts with a blizzard in progress.

By the beginning of winter, you should have stockpiled one-half to three-fourths of the amount of deicing material you expect to use this winter. Reserve piles and "self-help" barrels for motorists to use at trouble spots are also good to have on hand.

Properly store salt and other chloride compounds to prevent leaching, which harms the environment and may endanger the health of residents.

Let the media, police, fire and other officials know about your winter snow control plans. Provide citizens with a telephone number at which they can reach the road crew in an emergency.

Consider contracting with a private forecasting firm that gives localized coverage for your area.

Winter Operations

As soon as a snow warning is received, get equipment ready and into location to start the snow removal process. You'll save time and prevent traffic tie-ups.

Turn the cinder spreader around and mount it to the truck frame so that cinders fall in front of the rear tires. This will provide instant traction and eliminate the need for chains.

Make sure plows are set at a right angle both vertically and transversely. If they are set at the wrong angles, plows can require more effort to push, resulting in greater fuel consumption.

If you are only plowing, your truck should be no more than one-half loaded with deicer, and the truck bed should never be raised.

To save fuel, use the optimum gear ratio when plowing.

Begin deicing as soon as snow starts to accumulate to keep snow and ice from bonding to the pavement. When spreading deicing material on two-lane roads, make sure the truck straddles the center line of the road. This saves time and fuel because the spreader has to make only one pass on these roads.

Take advantage of nature when deicing. Let the wind help to spread salt and cinders over the road. On elevated curves, let gravity work by spreading on the high part of the curve.

To know when to reapply deicer to the road, watch the tires of cars traveling along the road. If snow falls directly behind the tires, it is time to reapply salt or cinders. If snow fans out under the tires, however, the deicer is still working.

When spreading deicer or plowing and spreading simultaneously, never raise the truck bed higher than the top of the cab. Always stop the truck, raise the bed, shift the material to the spreader and then lower the bed.

Consider continuous plowing of both roads and road shoulders during a snowstorm. That way, if another storm occurs within a few days, only fresh snow has to be plowed.

Once the snow has stopped and plowing is finished, return to areas where drifting has occurred. Take two trucks on tandem and clear out the excess snow before it has time to harden. It is easier to push the drifts away from the road or to cut down drifts when the snow is still fresh.

Clear drains and catch basins to allow melting snow and ice to run off. Clear snow from barrier walls and traffic dividers to reduce later melting and refreezing of snow and to increase driver visibility. Also plow and haul snow away from sharp corners and bends to increase visibility.

Remove the windrows on the sides of bridges to prevent drifting. If windrows are allowed to remain, available roadway will be reduced and snow will later melt and form ice.

Clear snow from raised medians to prevent drifting. If drifting does require roads to be closed, use a front end loader to shove banks back as far from the road as possible to keep them from building up near road shoulders.

After returning to the garage, check the trucks, including wipers, lights, oil, antifreeze, blades and hydraulic systems. Make sure to fuel and load trucks so they are ready to go at the next sign of snow.

Use fencing to prevent drifts and to reduce the need for snow and ice control.

Preventive maintenance of equipment should be performed throughout the winter months after every 100 hours of service. This will add years to the life of the equipment and will keep "down-time" to a minimum.

This checklist is reprinted from *Technotes*, which is published by the Technology Transfer Center at the University of Maryland.

For More Information

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