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Acronyms in this issue

AASHTO	American Association of State Highway and Transportation Officials	ISU	Iowa State University
CTRE	Center for Transportation Research and Education	LTAP	Local Technical Assistance Program
FHWA	Federal Highway Administration	MUTCD	Manual on Uniform Traffic Control Devices
Iowa DOT	Iowa Department of Transportation		

Managing drifting snow

PREVENTING SNOW from drifting on roadways is less expensive and time consuming—and safer for motorists and maintenance crews—than removing it from the road.

For example, plowing snow can cost up to 100 times more than installing snow fences.

Three general guidelines for reducing snow drift on roads include shaping the roadside topography, minimizing the use of roadside guardrail, and placing snow fences.

Shaping topography

Perhaps the best way to control drifting snow is to shape the roadside landscape appropriately. Ideally, this is accomplished when the roadway is designed, but sometimes the topography of existing roadways can be improved or reshaped in the following ways. (Implementing either technique likely requires a right-of-way agreement.)

Enhance ditches. Snow tends to accumulate in sheltered depressions rather than on the higher ground around the depressions. Widen and deepen ditches to increase their capacity to contain blowing snow and snow plowed off the roadway surface.

Eliminate snow traps. Snow traps occur when road-sides are higher than the road's surface. Blowing snow collects and swirls in these depressions, creating hazardous road conditions. Eliminating snow traps involves removing embankments to flatten the adjacent roadside and constructing adequate ditches.

(For how-to suggestions regarding removing snow traps, see a related article in the November/

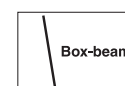
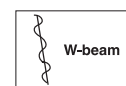
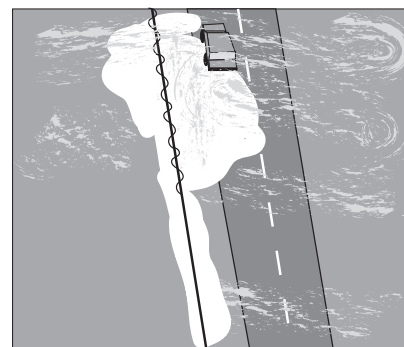
December 2000 issue of *Technology News*, www.ctre.iastate.edu/pubs/Tech_News/2000/.)

Minimizing the use of roadside guardrail

Roadside guardrail can trap snow on the roadway. Ideally, good road design eliminates or minimizes the need for many guardrail installations. For example, building gentler slopes on embankments and ditches and extending culverts can reduce the need for guardrail.

However, when guardrail is necessary, choose designs that interfere as little as possible with snow removal activities. Of the four common designs—box-beam, cable, concrete, and W-beam—box-beam and cable may be preferable because they allow better airflow and interfere less with snow removal activities. As illustrated below, blowing snow can move more freely through box-beam guardrail but tends to collect in drifts near W-beam rail.

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Modify existing guardrail so it doesn't collect drifting snow by anchoring the ends in the back slope or flaring ends away from the roadway.

Placing snow fences

When reshaping topography is not an alternative, the next best choice is to manage blowing snow in such a way that drifts form adjacent to the roadway instead of on it. Snow fences, living and artificial, decelerate snow-laden winds, causing snow to collect at the point of deceleration rather than on the road.

The theory is simple enough, but properly installing snow fence is a science that considers overall topography, average wind speeds, fence design, and other factors. Inappropriately placed or designed snow

fences can actually exacerbate the formation of snow drifts on roadways.

Artificial snow fences. Artificial, or structural, snow fences can be temporary or permanent.

Temporary structures, generally four-foot high, portable plastic or wooden fences, are usually installed after the fall harvest and removed before spring planting.

Permanent structures of various designs and materials generally occupy a narrow strip of land and require little maintenance.

Living snow fences. Trap snow "naturally" by (1) planting living snow barriers, (2) leaving cropland untilled, or (3) leaving a few rows of unharvested corn in the field.

Understanding how snow moves

Understanding the characteristics of blowing snow can help you select optimum strategies for reducing snow accumulation on your roadways. Snow generally moves in three ways: by creep, saltation, or suspension (also called turbulent diffusion).

Particles too large to be lifted off the ground in a light wind *creep* or roll along the ground surface. Creeping snow is easily trapped by snow fences.

Lighter snow particles may *saltate*, or jump along the ground. These particles rise vertically and then return to the surface at a shallow angle trajectory. Saltating particles can be particularly problematic because they can dislodge particles that have become frozen to surface material, increasing the amount of blowing snow. The good news: saltating snow is also easily trapped in snow fences.

Suspended snow has become airborne and remains so for extended periods of time. Particles become suspended when the wind is strong and/or snow particles are relatively small. Once suspended, they become smaller through evaporation and then tend to be carried even higher.

Most blowing snow is in suspension, with the greatest amount of suspended snow within three feet of the surface. Suspended snow only stops moving in sheltered areas. To be caught in a snow fence, suspended snow must settle in a sheltered area.

Snow particles do not move for long distances. As they move, they break into smaller pieces, perhaps become airborne, and eventually evaporate.

For more information

Both *Design Guidelines for the Control of Blowing and Drifting Snow* (P2381), a publication of the Strategic Highway Research Program, and *Controlling Drifting Snow* (P718) by Stanley Ring, Iowa State University professor emeritus of civil engineering, contain helpful discussions of snow movement. Contact Jim Hogan, CTRE's library coordinator, 515-294-9481, hoganj@iastate.edu. •

(1) Buffer strips of native grasses adjacent to roadways can resist the weight and slow the speed of moving snow, trapping snow from two to three average snowstorms. They can also help prevent silt accumulation in ditches, reserving the space for snow.

One aspect of the reauthorized federal Conservation Reserve Program (CRP), which provides conservation incentives to landowners, involves planting such buffer strips.

Rows of trees or shrubs can also make effective snow fences. The distance that snow will drift on the lee side of the windbreak depends on the windbreak's permeability.

Less permeable windbreaks cause snow to accumulate in deep, narrow drifts; more permeable windbreaks cause snow to accumulate in shallow, wide drifts.

The Iowa DOT's general living snow fence design consists of two rows (five feet apart) of trees and shrubs, with plants spaced three feet apart within each row. Rows are placed at a distance from the roadway at least 10 to 12 times (preferred, 15 times) the height of the plants.

The Natural Resources Conservation Service (NRCS), one of CRP's partners, offers a cost-share program with farmers for planting trees and shrubs to serve as windbreaks.

(2) Natural vegetation on untilled acres can help prevent snow from blowing onto roadways.

The NRCS also pays landowners to leave highly erodable lands untilled. (Landowners may remember a similar state program called the Wind Erosion Control Incentive Program (WECIP).)

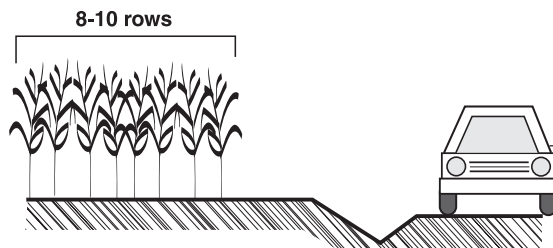
(3) For several years, some Iowa counties and the Iowa DOT have contracted with farmers across the state to leave a few rows of corn unharvested in their fields, parallel to the roadway, as a snow barrier. The program can benefit both agencies and farmers.

For more information

For more information about

- designing and placing snow fences, see SHRP's *Snow Fence Guide*, P801.
- working with landowners to install temporary or permanent structural fences, contact Dennis Burkheimer, Iowa DOT winter operations administrator, 515-239-1355, dennis.burkheimer@dot.state.ia.us.
- working with farmers to leave rows of corn in their fields through the Iowa Cooperative Snow Fence Program, contact Dennis Burkheimer, Iowa DOT winter operations administrator, 515-239-1355, dennis.burkheimer@dot.state.ia.us.
- working with the Natural Resources Conservation Service and Conservation Reserve Program to create living snow fences, contact your local National Resource Conservation Service (NRCS) office. For Iowa office information, see the NRCS web site, www.nrcs.usda.gov/.
- understanding the snow drift implications of guardrail, contact Safety Circuit Rider Tom McDonald, 515-294-6384, tmcdonal@iastate.edu.
- controlling drifting snow, see the Strategic Highway Research Program's (SHRP) *Design Guidelines for the Control of Blowing and Drifting Snow*, P2381.

To borrow the referenced publications, contact Jim Hogan, CTRE's library coordinator, 515-294-9481, hoganj@iastate.edu.



Temporary snow fence of corn rows (not to scale)

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