Snow fences are often used to minimize blowing and drifting snow on highways.

RESEARCH SOLUTIONS

Designing snow fences that are efficient and cost-effective

Heavy snowfall and high winds can create hazardous road conditions in Iowa's wide-open landscapes. Blowing and drifting snow increases the need for snow removal and maintenance activities. A snow fence installed along the roadway can reduce the snow's movement, but an effective fence design depends upon a variety of factors, including the area's snowfall potential and where accumulation is likely to occur. To help engineers determine the size and type of snow fence to use for a particular location, researchers developed new methods for measuring and tracking snow in Iowa.

THE NEED

Across the United States, snow fences are commonly deployed to keep blowing and drifting snow from entering a roadway. These structures can be living — made of a row of trees, shrubs, or short or tall vegetation — or constructed from plastic or woven fabric and structural supports. To be effective, the snow fence must be able to accommodate the snow that is likely to accumulate in the area. A fence that is too small could be insufficient to properly hold the snow in place, while a fence that is excessively large wastes taxpayer dollars and requires unnecessary maintenance.

Iowa's snow fence designers have traditionally used a default value for estimating the amount of snow that a snow fence will need to capture. To determine whether the state's actual conditions might allow for more cost-effective snow fence designs, the Iowa Highway Research Board (IHRB) sought to develop an

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"By building snow fences that are right-sized for their location, we can effectively minimize blowing and drifting snow without overspending."

— **TINA GREENFIELD,**
Iowa DOT Road Weather Coordinator

Iowa-specific value that could produce more accurate snow quantity estimates, yielding snow fence designs that are better suited to their local environment.

RESEARCH APPROACH

To quantify the amount of snow that is transported by wind in Iowa, the researchers worked with state and county engineers to identify three test sites where high winds and drifting snow are common. Both living and constructed snow fences were present at each site. A variety of cameras, sensors, and other instrumentation tools installed nearby continuously monitored the areas in real time to measure snowfall, wind speed and direction, and other relevant meteorological and topographical conditions. Drone imagery, as well as publicly available data sources, provided additional information and ensured accurate mapping.

Direct, on-site observations and measurements were taken at each of the test locations over two winter seasons to supplement the images and data that were collected automatically. During the test period, 12 significant storms took place at these locations. Changes in snow deposits near the fences were measured and mapped during and after the storms to show how the fences affect the shape of the deposited snow. Mathematical formulas that account for annual snowfall quantities, roadway geometry, and site topography were applied to the data to accurately predict the volume of snow that would likely accumulate at a specific location.

WHAT IOWA LEARNED

The research showed that the default values Iowa has been using to estimate snow drifts are likely higher than necessary. Additionally, while Iowa may experience high snowfall totals over the course of a typical season, the freeze-thaw cycles that routinely take place in the state reduce the volume of snow that's present along the snow fence at any given time. As a result, Iowa's snow fences can likely be designed to hold a smaller capacity of snow than previously determined.

PUTTING IT TO WORK

With a new Iowa-specific value for estimating snow drifts, snow fence designers can be confident that the structures they design will be better sized and suited for their locations.

In the future, similar tests at other locations in Iowa could be conducted to account for local landscape variations. But the methods that were developed in this project to monitor site conditions have been shown to produce accurate, repeatable, and consistent results, and can be used to design cost-effective snow fences that will perform well for years to come.

ABOUT THIS PROJECT

PROJECT NAME: Reducing Uncertainties in Snow Fence Design: Methods for Estimation of Snow Drifting and the Snow Relocation Coefficient
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