

Snow: Blowing and Drifting Snow Control

Contact

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Purpose

Blowing and drifting snow on Minnesota's roadways is a transportation efficiency and safety concern. By deploying blowing and drifting snow control measures such as proper grading, structural snow fences and living snow fences, minimizes the negative impacts blowing and drifting snow can have on Minnesota's economy and on the well being of its citizens.

According to the Minnesota Division of Emergency Management the number one natural disaster claiming the most lives in Minnesota is winter storms. Hazardous driving conditions associated with blowing and drifting snow leads to an average of 8 fatalities and 284 injuries per year on state highways. The justification for implementing proactive, preventative blowing and drifting snow control measures will:

- Improve public safety,
- Reduce snow removal and road maintenance costs,
- Provide economic benefits in travel time saved.

Threshold Criteria

Blowing and drifting snow control needs to be addressed in project documentation if the project occurs on a section of roadway that Mn/DOT District Operations has identified as a snow trap problem. Call your District Operations for information about existing snow trap problems.

Prepared Statements

No snow trap problems are identified on this project or will be created as a result of this project.

OR

There are snow trap problems on this project, however, construction of this project will deploy preventative blowing and drifting snow control measures to solve the problem.

Relationship to the HDPD

For class I, II and III Actions, ensure that all mitigation commitments are incorporated into the PS & E package (when appropriate) during detail design.

Agencies Involved

Projects involving snow traps require coordination. The extent of that coordination can vary from submittal of a signed project document to field reviews, formal correspondence and reviews of draft reports. The type and timing of coordination depends on the magnitude of the snow trap impact and agency interest. Contact Office of Environmental Services for assistance in determining the appropriate level of coordination on each project involving snow traps.

AGENCY (S)	HOW THEY ARE INVOLVED
United States Department of Agriculture Natural Resources Conservation Service	Statutorily responsible for certifying that each living snow fence enrolled in the federal Conservation Reserve Program is technically correct
United States Department of Agriculture, Farm Services Agency	Statutorily responsible for administering the federal Conservation Reserve Program
Soil and Water Conservation Districts	Provide design build assistance for the private landowner contacted about implementing a living snow fence practice

Permits and Approvals

Permit/Approval	Agency with Oversight
CP17A-Living Snow Fence Practice	United States Department of Agriculture Farm Services Agency

Legal Basis

Description	Code
Easement may include snow fences http://www.revisor.leg.state.mn.us/stats/117/21.html	Minnesota Statute 117.21
Planting and tending trees/shrubs to protect highways from drifting snow. http://www.revisor.leg.state.mn.us/stats/160/22.html	Minnesota Statute 160.22

Guidelines/Regulations

Creator	Subject of guideline/regulation	Date
Strategic Highway Research Program	Design Guidelines for the Control of Blowing and Drifting Snow	1994
Mn/DOT Agreement Number 75966	Recommended Drift Control Measures for Selected Sites in Southern Minnesota	1997
Mn/DOT http://www.dot.state.mn.us/environment/livingsnowfence/pdf_files/marketing.pdf	Snow Fence Market	1999
Interagency Living Snow Fence Task Force	Catching the Snow with Living Snow Fences	1999
Mn/DOT	Procedures for Snow Fence Description Delineation	1999
Mn/DOT	Snow Fence Easement Language	2000
University of Minnesota http://climate.umn.edu/snow_fence/	Climatological Characterization of Snowfall and Snowdrift in Minnesota	2002

Mn/DOT	Memorandum of Understanding between Mn/DOT, USDA, and MASWCD http://www.dot.state.mn.us/environment/livingsnowfence/forms.html	2002
Mn/DOT	Benefit Cost Model http://www.dot.state.mn.us/environment/livingsnowfence/costbenefit.xls	2002
University of Minnesota	Drift Free Roads Design Module Web site http://climate.umn.edu/snow_fence/Components/Design/introduction.htm	2002
Mn/DOT	Drawing Snowdrift Prediction Model onto Proposed Cross Sections with GEOPAK	2002
Mn/DOT	Living Snow Fence Partner Forms and Information http://www.dot.state.mn.us/environment/livingsnowfence/forms.html	2002
USDA Farm Service Agency	Continuous Conservation Reserve Program http://www.fsa.usda.gov/pas/publications/facts/html/crpcont03.htm	2002
Mn/DOT	Information Resource Management Project P469 Snow Trap Inventory	2002

Glossary

Snow Trap: A snow trap is a section of roadway that experiences problems associated with blowing and drifting snow.

- Within snow trap areas motorists experience reduced visibility and/or icy, slippery road surface conditions resulting from "blow ice". In extreme cases, large snowdrift formations make the highway impassable, resulting in road closures.
- Mn/DOT spends extra money on snow traps in the form of heavy equipment, extra labor and salt used to keep the highway open or even reopen it after a blowing snow event.
- Historically snow traps have a high accident history because of blowing and drifting snow.

Blowing Snow: Blowing snow reduces visibility causing travel delays and can lead to the formation of slush and ice on the road.

Snowdrift: Snowdrifts can cause loss of vehicle control, reduce sight distance on curves and at intersections, obscure signs, cause ice formation, reduce effective road width and render safety barriers ineffective. Drifts directly contribute to pavement damage by blocking ditches, drains, culverts and can cause water to infiltrate beneath the pavement.

Flattening Backslopes: In general, the minimum distance from the edge of pavement to the toe of the backslope should be 46 feet, and the bottom of ditches should be at least 4 feet below the road shoulder. To completely eliminate a drift on the road, the distance from the edge of pavement to the top of the cut (W_{top}) can be estimated by the equation:
 $W_{top} = (29 + 5.8H_c)\sin a$

H_c is the depth of cut measured from the shoulder, a is the angle between the wind direction and the road (90 degrees if the wind is perpendicular to the road), and dimensions are in meters. In the case of sections with a cut on both sides of the road, the cross-section geometry on the downwind side also affects snowdrift formation on the road, and the same guidelines must be applied on both sides of the road in order to achieve a snowdrift free section.

The backslope should be as steep as possible to maximize the volume of snow stored in the cut.

Raising the Grade: The equation $H_e = 0.4S + 0.6$ (where S is the mean seasonal snowfall in meters) gives the guideline for the minimum height of the edge of pavement above the surrounding terrain. The purpose of raising the grade is to facilitate the movement of blowing snow over the roadway to minimize drift formation on the road. This works best in open areas where the wind has enough force to blow the road clear of snowdrifts. Thus driver visibility is not improved. Raising the grade is not as effective when buildings, bridges, farmsteads and (vegetation taller than 4 feet in height) are next to or within the highway right of way, because these features reduce the winds velocity causing the blowing snow to settle on the road.

Structural Snow Fence: Structural snow fencing is best suited for sites that are not conducive for tree and shrub plantings. The following factors may preclude the use of living snow fences:

- Herbicide concerns
- Unavoidable tile lines
- Soil pH above 8.0
- Soil salinity and/or salt spray

- Soils types that are too compacted, wet, dry an/or rocky to permit normal root development
- Presence of a deer wintering area that raises the threat that a living snow fence will be browsed to the point that the living snow fence never reaches the required fence height

Living Snow Fence: Plantings of trees, shrubs and native grasses located along roads or around communities and farmsteads. Properly designed and placed, these living barriers trap snow as it blows across fields, piling it up before it reaches a road, waterway, farmstead or community.