8.9 # A Discussion of Geospatial Character of Roadway Vegetation Roughness

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## 1. ABSTRACT

Winter travel in the northern portions of the United States can be hazardous during times of blizzards, winter storms, and blowing snow events. For surface transportation, precipitation does not have to be falling in order for travel to become hazardous. Wind can transport snow from previous snow events onto the roadway, reducing visibility and accumulating in significant amounts to result in reduced traction and ice build-up on the roadway. The spatial pattern of roadway snow accumulation at a given site depends on the orientation of the roadway with respect to the prevailing winds during the event, the amount of snow mass present, and vegetative surface roughness factors along the roadway. Identifying the surface roughness and/or vertical extent of the vegetation is a geospatial problem that can be accomplished with ground-based observations.

The University of North Dakota (UND) Surface Transportation Weather Research Center (STWRC) has been a national leader in the development of traveler information systems in combination with North Dakota Department of Transportation, South Dakota Department of Transportation, and the Federal Highway Administration; its location within the upper Midwest offers an excellent opportunity for Rural Geospatial Innovations-Great Plains to assist rural America with traveler safety. Blowing snow models are currently being developed at UND STWRC that would benefit greatly if detailed information on surface roughness and/or obstructions could be incorporated into the model.

This presentation will illustrate the work that has been done to improve the geospatial variability of roadway vegetation roughness (defined as the roughness associated with vegetation cover within a distance that affects the roadway conditions) used within a blowing snow model. It will highlight the need for an updated roughness categorization as well as examples of the updated categories within surface transportation weather research. The use of video mapping along a roadway will be discussed, as well as the process involved with building a GIS dataset from collected video.

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## 2. VEGETATION EFFECTS ON SNOW

A large part of snow accumulation is due to wind obstructions. Essery and Pomeroy (2004) state that snow is eroded from sparse or low vegetation and exposed sites and is transported to denser, taller vegetation and to topographic depressions. The vegetation acts as a snow fence and breaks the wind flow into eddies allowing the particles to fall to the ground (Ahrens, 2000). Tabler (1980) found that drifts are scaled in proportion to the snow fence height over a range of nearly two orders of magnitude. Studies have shown that vegetation can have a fetch up to 25 times its height and that the minimum airflow is typically at a distance of 4 times that of the vegetations height (Ahrens, 2000).

In many instances significant vegetation is present along a roadside. This roadside vegetation does play a role in determining a blowing snow susceptibility, which is affected by vegetation type, size, and location.

The vegetation along a roadway will accumulate snow during times of blowing snow. However, the vegetation will reach a maximum holding capacity at which time the blowing snow will not be trapped within the vegetation. The blowing snow not caught within the vegetation will be swept across the roadway effectively causing a change in driving conditions. Blowing snow is the dominant cause of icy roads in exposed areas, where approximately ¾ of traffic incidents along a section of I-80 in Wyoming were caused by icy roads (Tabler, 2003). This is the ultimate goal of the roadway vegetation study, to supply a vegetation data set along a roadway corridor to be used within blowing snow modeling.

## 3. PROJECT SUMMARY AND METHODOLOGY

This project consists of two route corridors and their vegetative patterns. The first route is a north-south Interstate corridor while the second is an east-west US highway corridor. Both of the selected corridors are similar in length (32 kilometers and 40 kilometers respectively), and have similar vegetation types and arrangements as well as terrain features. The vegetation consists mostly of deciduous trees and underbrush mixed with the occasional coniferous tree. Typically the vegetation is in shelterbelts either parallel or perpendicular to the roadway. The terrain is relatively flat; the routes are within the Red River Valley of eastern North Dakota that has a slope of approximately 0.3 meters per kilometer. The routes were selected based on the similarity of vegetative and terrain features and the need for data creation in those areas.

Vegetation for each segment has been recorded in each direction along the roadway using a video mapping system. Output from the video-mapping system is georeferenced video data. The video data is used within the GIS for digitizing and creating vegetation data sets. Video collection will also be used for validation of case studies and for the correlation of drifting/blowing snow with respect to the location of the vegetation. This correlation will be tracked throughout the winter season to monitor drifting/blowing snow tendencies and temporal changes.

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