The Ohio Department of Transportation
Office of Research & Development
Executive Summary Report

Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations - Part V: Vehicular Speed Associated with Winter Pavement Conditions

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Problem

According to ODOT the level of service provided on a pavement surface during a winter storm event represents the measure of efficiency and effectiveness of a given snow and ice control program. Accurate and timely identification of pavement surface conditions during a winter storm event is a critical element within the establishment of desired levels of service. The identification of a surface condition is usually established through comparison with standards based upon the percentage of visible bare pavement and the apparent slickness of a pavement surface within a given timeframe. Typically conditions are subjectively identified through visual inspections by field personnel and through informational input from the local driver. Due to this subjective nature it is difficult to maintain and establish a statewide consistency in pavement surface conditions during winter weather events. Objective criteria to assist in the identification of a level of service would be an enormous benefit to creating and maintaining a uniform and consistent pavement surface condition during a winter storm event within localized areas and across multiple jurisdictions.

Objectives

The primary objective of this study was to develop a procedure to determine the level of service in terms of RWIS (Road Weather Information System) speed measurements. The aim then is to use the RWIS data to derive the level of service for winter maintenance operations after identifying and classifying the factors affecting the level of service during a major winter storm.

Description

The project consists of two major efforts: To identify the factors affecting the winter traffic

speeds and use the historical RWIS speed data correlated to the level of service, determine the level of service as perceived by the drivers in Ohio. The factors affecting the winter travel speed were determined by doing a national literature search and a brief survey of state DOT's to see whether any work has been done to relate speed with the level of service. Driver surveys were conducted at rest area buildings and responses of both the car and the truck drivers were analyzed separately and together to determine the perceived level of service by Ohio motorists. The surveys were administered during a major snow storm at each of two rest areas along interstates in northern Ohio. Level of service information was collected for these sites during the storm events and related to RWIS speed data measured at the same time. In the study, it was found that the average traffic speeds were significantly lower during a major snow storm even when periodic plowing and salting was done. The average RWIS speeds decreased almost linearly for the period of the snow storm, reached the minimum and then climbed back slowly towards higher speeds. The speeds appear to be a fairly sensitive measure to judge the condition of the pavement when visibility was not a major problem.

Recommendations

A simple procedure was developed for winter maintenance management to determine the condition of the road surface (freeways) based on the average speeds observed by the RWIS sensors. If the average winter speed of the traffic is equal or greater than the historical established wet/salted and snow free average pavement speed, the level of service is considered adequate. Based on the Swiss data, the wet/salted surface average winter speeds are about 85% of the average dry surface speeds for freeways and 96 % for the city streets. If the average winter speed is below the average dry surface speed, the level of service is considered inadequate. Any average speed less than 50% of the average dry surface speed indicates fairly bad road conditions and a highly inadequate level of service. It should be noted that the winter pavement conditions can be highly dynamic. Depending on the rate of accumulation of snow, frequency of snow plowing, length of the snow plow route, the pavement condition can improve and detoriate a number of times during an extended winter storm. The level of service can get worse even with maximum snow plowing and salting effort in a situation where the rate of accumulation of snow is very high. The average winter speeds observed as a percentage of the average dry surface speed can be further correlated with the level of service. A relatively more fine arbitrary graduation of the level of service as a function of the percentage of the average dry surface speed is proposed as follows: 76-100% of the average dry surface pavement speeds would be considered as an adequate level of service; 68-75% as slightly inadequate; 60-67% as moderately inadequate, 51-59% as inadequate; 42-50% as highly inadequate and less than 41% as extremely inadequate. It should be noted that these recommended percentage ranges of the average dry pavement surface speed to determine the level of snow and ice control operations are not applicable to weather conditions such as dense fog where driving visibility is severely limited and the driving speeds are very low.

It should be noted that due to the lack of winter storms in the Cleveland\Akron area during the 2004, 2005 and 2006 years, the findings of the study are somewhat limited and based on a small sample of winter conditions. Therefore the recommendations proposed must be considered as fairly general and are also based on the results from a recent winter maintenance study conducted in Switzerland. The statements regarding the level of service only reflect a small sample of actual winter conditions and appear biased towards rather severe winter snow storm conditions.

Implementation Potential

The procedure developed in this study should be ready for implementation, however it should be monitored over a few winter seasons by comparing then with traditional level of service determinations to fully establish confidence and validity in the procedure. It may be best to implement this procedure first in northeast Ohio – Cuyahoga, Summit, and Ashtabula counties, where existing speed measurement sites and major snow storms are most likely.

It should be noted that a full statewide implementation of using the RWIS average speeds as a level of service indicator will require filling in holes in the RWIS speed data collection network in Ohio. The level of service procedure proposed in the study is more quantitative compared to the subjective definition of level of service used in the past because actual speed measurement from RWIS sensors will be used in the decision making guidelines for snow and ice removal operations. Though some training is required for ODOT personal to use the new level of service procedure, it will improve the monitoring and evaluation of the winter maintenance operations for compliance and validation.