CHEMICAL SPREADERS FOR ANTI-ICING APPLICATIONS

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Like a bloated sumo wrestler in an all-you-can-eat restaurant, we have not learned to push away from the table salt and have a near-insatiable craving for the white stuff on our roads. Though it is unlikely we can kick the habit completely (after all, it's cheap and effective), one of Strategic Highway Research Program's (SHRP's) objectives is to put the country on a diet--reducing the amount of deicing chemicals.

One approach initiated in 1991 is the development of anti-icing technologies. Anti-icing, as contrasted with deicing, involves the application of a freezing point depressant on the pavement before the onset of precipitation, or at the latest during the very early stages of a freezing precipitation event. The potential for reduced chemical application lies in the fact that once snow or ice falls on an untreated pavement, there is a very high probability of a strong mechanical bond developing between the snow or ice and the pavement that requires excessive quantities of chemical to remove--the chemical must penetrate the frozen mass to reach the pavement interface to dislodge the ice. An anti-icing treatment, on the other hand, prevents the ice or snow from developing that strong bond, thus facilitating mechanical removal by plowing or traffic action.

In cooperation with nine participating states (CA, CO, MD, NV, MO, MN, NY, OH, WA), field observations were conducted during winter 1991/92 at 15 sites in four climatic regimes. Each site included a test section where an anti-icing treatment was applied, and a nearby control section where the conventional deicing approach was followed. Anti-icing treatments included reduced application rates of the state's conventional treatment, or prewetted salt or liquid magnesium chloride. Because an informed decision on when to start applying an anti-icing chemical is based on the best available weather forecast, sites were selected where either site-specific weather forecasts were provided from a contract meteorological service or where road weather information systems were installed, or both. However, the mild winter resulted in only 51 storm events recorded in seven of the states.

Since one of SHRP's objectives is the application of low quantities of chemical that may be below the capabilities of current agency application equipment, the Minnesota Department of Transportation is evaluating current equipment capabilities as a subcontractor to SHRP's prime contractor, Midwest Research Institute. A third contractor, Michigan Technological University's Keweenaw Research Center, is conducting controlled tests on an unused airport runway to assess the effectiveness of several chemicals, in liquid or solid form and at two application rates, in terms of their effect on friction as a function of time. Friction is measured using a Saab Friction Tester every 15 minutes after chemical treatment for up to two hours. Limited trafficking is performed to simulate highway conditions.

Some results of the spreader equipment testing has been provided by the MnDOT. In the absence of any recognized protocol for evaluating spreader performance, MnDOT has embarked on an effort to develop one. Several variations of areal distribution measurement have been tried. Catching the salt leaving the spinner in pans laid in rows normal to the direction of truck travel is one (Figure 1). Another dispensed with the pans and merely collected the salt in marked areas either by hand-sweeping or by vacuuming with an industrial vacuum cleaner. The principal finding in these exploratory tests has been that the distribution of the salt spread by a spinner is exceedingly non-uniform, and varies with speed of the truck. The results of a test on one spreader operating at three trucks speeds (14, 20, and 25 mph) is shown in Figure 2. Though windrow, stripe, or band spreading of salt or other chemicals is an acceptable and useful technique for deicing, it is not the preferred method for anti-icing. Anti-icing is most effective when chemicals are applied uniformly on the pavement. This work is expected to result in recommendations for selection of effective equipment and for design of improved devices.

Figure 1 Pans laid in rows normal to direction of truck travel to catch salt leaving the spinner.

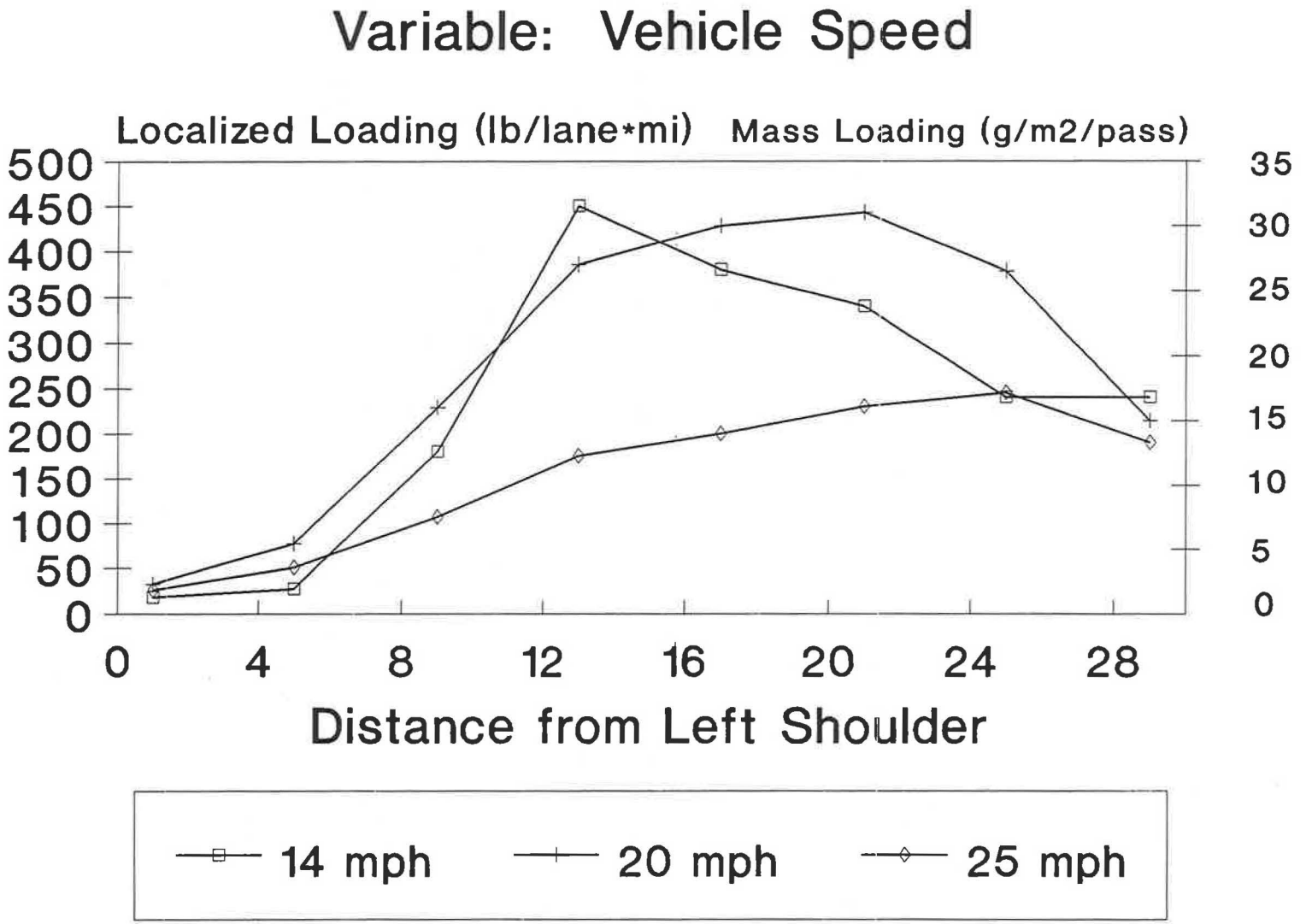

Figure 2 Changes in chemical spread pattern at different truck speeds.