

Title: Study on Winter Road Surface Friction Characteristics and Their Reproducibility

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Abstract:

In cold snowy regions of Japan, ensuring and maintaining safe, smooth road traffic flow in winter is an important issue. In this context, local road authorities constantly provide winter maintenance services including road facility development, snow removal and application of chemical agents even under budget constraints.

Towards efficient winter road management, it is necessary to be able to appropriately understand roadway conditions and to properly apply treatments to the road surface. Bearing this in mind, the Civil Engineering Research Institute for Cold Region has focused on road surface friction as a quantitative index of road condition to supplement the subjective understanding of road managers and operators. We established a method for continuously measuring road surface friction in terms of the Halliday Friction Number (HFN) and for understanding the distribution of HFNs. This method has allowed the quantitative assessment of road surface conditions, but it is still difficult to employ on all routes and constantly because of the financial constraints of road authorities involved in expanding the scope of the system and the frequency of its use.

Under such circumstances, we have been working to use the data from existing HFN monitoring to improve the accuracy in identifying road sections that require careful management with a minimum of measurements. If successful, the method will be able to support strategic decision-making on winter road management. The studied site is on National Highway 230 in the Greater Sapporo area, where we are monitoring HFNs in winter. Using the data obtained and stored during the monitoring, we determined the occurrence rate of the winter road surface conditions. Also, we are investigating road surface friction characteristics under different weather conditions and the capability of reproducing road surface friction profile. In order to understand road surface friction characteristics and to examine the reproducibility of each road surface friction profile, the obtained monitoring data were sorted by weather condition. Daily minimum temperature and 12-hour nighttime snowfall were used to classify weather conditions.

Our study found the following. (1) The occurrence rate of HFN is influenced not only by weather conditions but also by maintenance operations. (2) With regard to road surface friction characteristics and their reproducibility, the HFN distribution differed between days with versus without snowfall, although the rate of snowfall did not seem to affect the HFN distribution. (3) With regard to the reproducibility of road surface friction profile, a certain level of reproducibility was confirmed quantitatively, from a limited sampling of the data.