Preliminary Study on Order-of-Magnitude Calculations for Highway Snow Drift Mitigation Engineering Design (Postprint)

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Abstract

The extreme value distribution, probability distribution of mean wind speed, and wind hours causing snowdrift for winter winds in the Naohai wind area of Altay, Xinjiang, were investigated using the Extreme Value Type I distribution and Weibull distribution. The intensity of snowdrift was quantified using extreme values, the domain of mean probability distribution, and snowdrift hours, and the calculated design magnitude for snowdrift prevention engineering was incorporated into highway design within snowdrift-affected regions. The results demonstrate that calculating the magnitude of snow prevention engineering through the mean wind speed from the Weibull distribution and the effective time distribution of snowdrift constitutes a calculation method for highway snowdrift prevention engineering; the design of snow prevention engineering does not have an explicit design magnitude indexed by return period, but rather only a disaster prevention magnitude exists.

Full Text

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Calculation of Magnitude of Snowdrift on Highway in Its Prevention Engineering Design

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Abstract: This study investigates the extremum distribution of winter wind, the mean wind speed probability distribution, and the duration of snowdrift conditions at the Naohai wind zone in Jimunai County, Xinjiang, China, employing both extreme type and Weibull distribution methods. The magnitude of wind-blown snow is quantified using extreme values, the average probability distribution area, and wind-blown snow hours. The computed snowdrift magnitude is incorporated into road engineering design for wind- and snow-affected areas. The results demonstrate that calculating snow protection engineering grades based on the mean wind speed derived from Weibull distribution and the effective time distribution of wind-blown snow offers a feasible approach for snowdrift prevention and control engineering on highways. While snow prevention project designs lack a clearly defined design level based on recurrence period, they do incorporate disaster prevention and control magnitude. Although the extreme type distribution can be applied to snow fence load calculations, it is unsuitable for wind-blown snow magnitude calculations. Utilizing Weibull distribution to calculate effective blowing time and average wind distribution effectively characterizes wind-blown snow intensity. Through this method, we determine that the effective wind and snow blowing time is 88.74 days, with a wind and snow magnitude of 452 $m^3 \cdot m^{-1}$ in the zone.

Keywords: highway; wind-blown snow; snow fence design; design frequency; Jimunai County

Note: Figure translations are in progress. See original paper for figures.