



Comparing “GRIP,” Traffic Speeds, and Safety Outcomes During Winter Storms



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Project Background

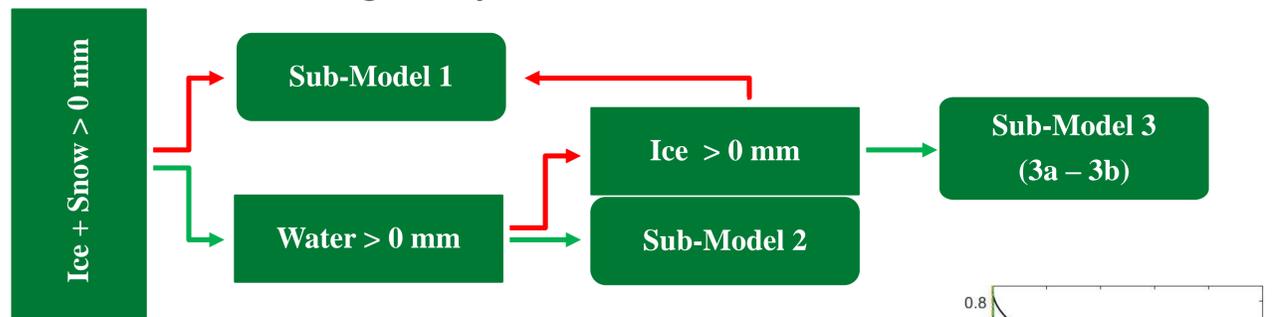
The Maintenance and Operations Bureau at VTTrans is working to implement objective performance measures to evaluate its winter maintenance activities. The Bureau has explored both speed and road condition-based performance measures, including measures based on Vaisala’s “Grip” metric.

Grip is an indirect friction measure calculated from the thickness of the water, snow, and ice layers present on the road surface using a proprietary methodology. Grip values range between 0 and 0.82 with 0.6 frequently used as a threshold to indicate adverse driving conditions.

The goal of this project is to further develop a winter performance measurement system by reverse engineering the Grip calculation methodology and exploring the relationship among Grip, traffic speed changes, and safety outcomes in the Vermont context.

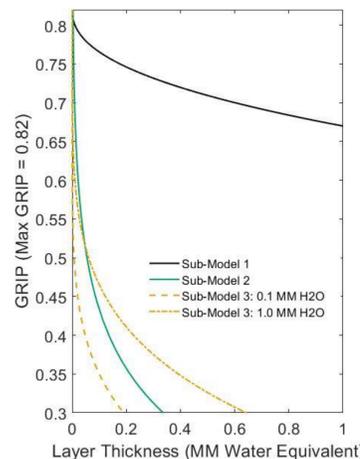
Reverse Engineering GRIP Formulation

Using data from winter 2016-2017, a three part model was derived for calculating Grip that yielded an R² of 0.96. The model was validated on the data from 2017-2018 and again it yielded an R² of 0.96.



Grip Calculation Model: Sub-Model Selection Logic

Model Functional Form	a	b	x	
Sub-Model 1	ax^b	0.15	0.44	Water
Sub-Model 2	$a \ln(x) + b$	0.11	0.64	Snow + Ice
Sub-Model 3a	ax^b	0.58	0.20	Ice
Sub-Model 3b	$a \ln(x) + b$	0.05	0.22	Water



GRIP and Speed Comparison

Safe roads at safe speeds require that the public respond appropriately to current road conditions. Speed changes can be measured using a metric called the ADD developed in a prior VTTrans research project. A high degree of correlation between Grip and speed changes would suggest that the public is responding appropriately and that these measurements could potentially be used interchangeably for performance measurement. Lower levels of correlation between the measures may indicate a need for greater public education about safe driving habits during winter storms.

Grip and speed changes were only moderately correlated (R² = 0.6) for the 2016 – 2017 dataset. Speed changes frequently occur before Grip is lost but in some cases speeds do not change even when Grip is highly compromised, potentially creating dangerous conditions.

Ongoing Research

- Instances when ADD and Grip diverge have been identified and are being cross-referenced with crash and state-police response data.
- Storm and seasonal winter severity indices are being reviewed so that final performance metrics can be normalized to account for storm severity.

