UTC Project Information	
Project Title	Measuring Dispersal and Tracking of Anti-Icing and Deicing Chemicals using In-Situ Hyperspectral Data – Phase II: In-Situ Terrestrial Field Data Collection
University	University of Alaska Fairbanks
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Funding Source(s) and Amounts Provided (by each agency or organization)	University of Washington PacTrans $67,000 Alaska DOT $67,000
Total Project Cost	$134,000
Agency ID or Contract Number	69A3551747110
Start and End Dates	September 1, 2018-August 31, 2020
Brief Description of Research Project	The management of anti-icing and deicing efforts are critical for mobility and safety of travel during the winter season in cold climates. The statewide cost of a winter road closure in Alaska has been estimated to be an average of $700 million per day. The use and application of salt, sand and related mixtures and derivatives have proven to be highly effective for controlling or removing the development of ice on the roadway surface. Although ample research exists indicating the way in which application method, application rate and efficacy of mix contents can vary depending on temperature and surface conditions. There is also substantial research on environmental impacts to soil and groundwater from anti-icing and deicing applications, as well as the corrosive properties of different types of chlorides. However, there is little if any research to suggest the longevity and dispersal of anti-icing and deicing compounds after they have been applied to the roadway surface (i.e., how long does it stay in place and where does it go post-application?). The objectives of this project are threefold. First, develop a robust in- field sampling plan to measure anti-icing and deicing chemical concentrations under varied environmental, geometric, and volumetric conditions. Second, conduct the field data collection. Third, develop and conduct a robust sampling strategy to quantify the amountof anti-icing and deicing chemical loss due to imposed processes. Lastly,use these findings to inform and improve winter maintenance efforts and strategies.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	Though this project successfully demonstrated the use of hyperspectral technologies for identifying and quantifying chemical concentrations of anti-icing chemicals on roadways, the currently available technologies on the market are cost prohibitive for large scale deployment. Future research will be needed to: 1) identify ways in which to reduce the cost of imaging units by either isolating specific wavelengths rather than obtaining full or broad spectra or by using other, less costly, methods that achieve the same or comparable results; and 2) mitigate the effects of environmental and lighting conditions that impart uncertainty in the data.

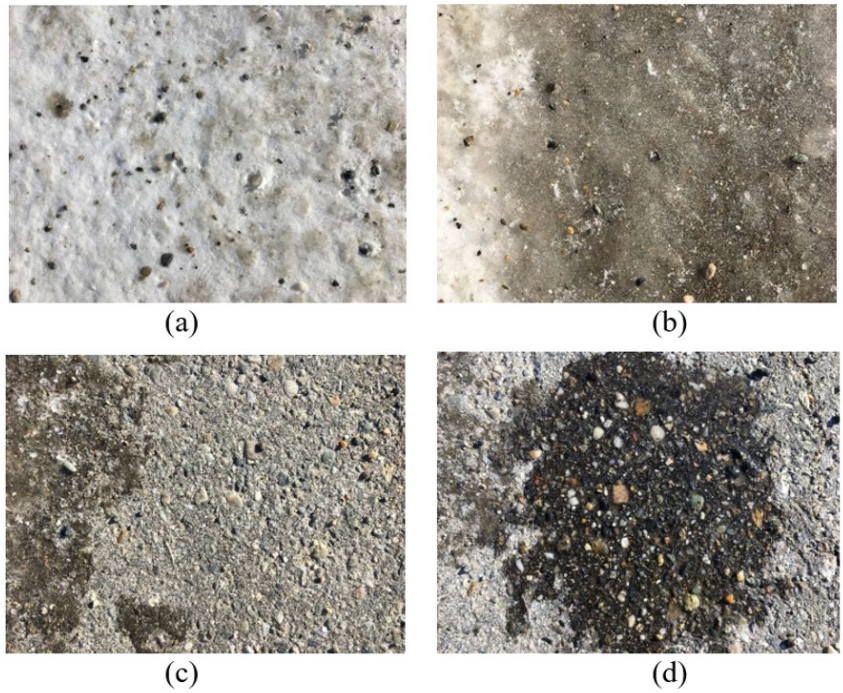

Figure 1. Example surface material showing (a) hard-packed snow with some gravel, (b) partially melted hard-pack with some ice, (c) bare pavement with some ice, and (d) pavement with wet brine added.

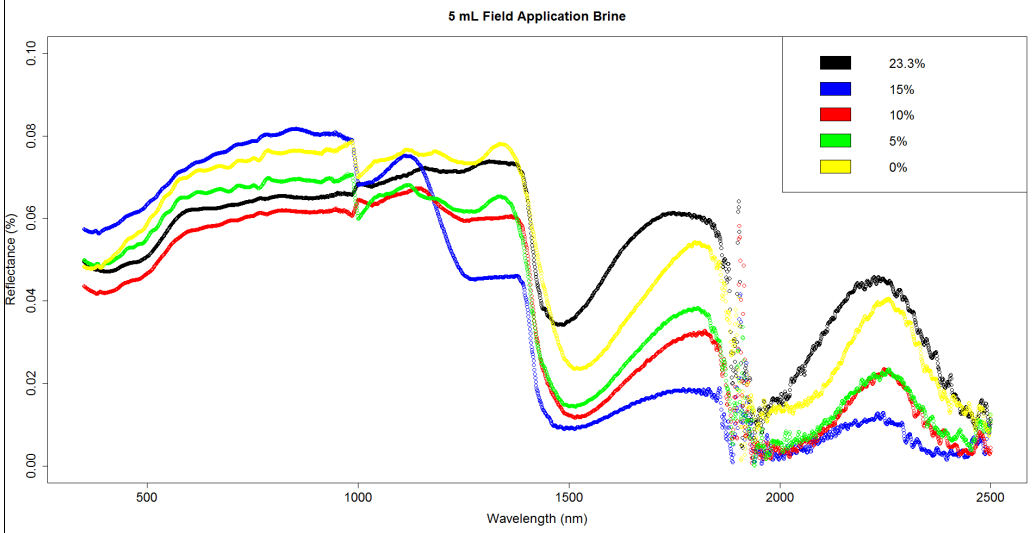

Figure 2. Field results for varied brine concentrations at 5ml application

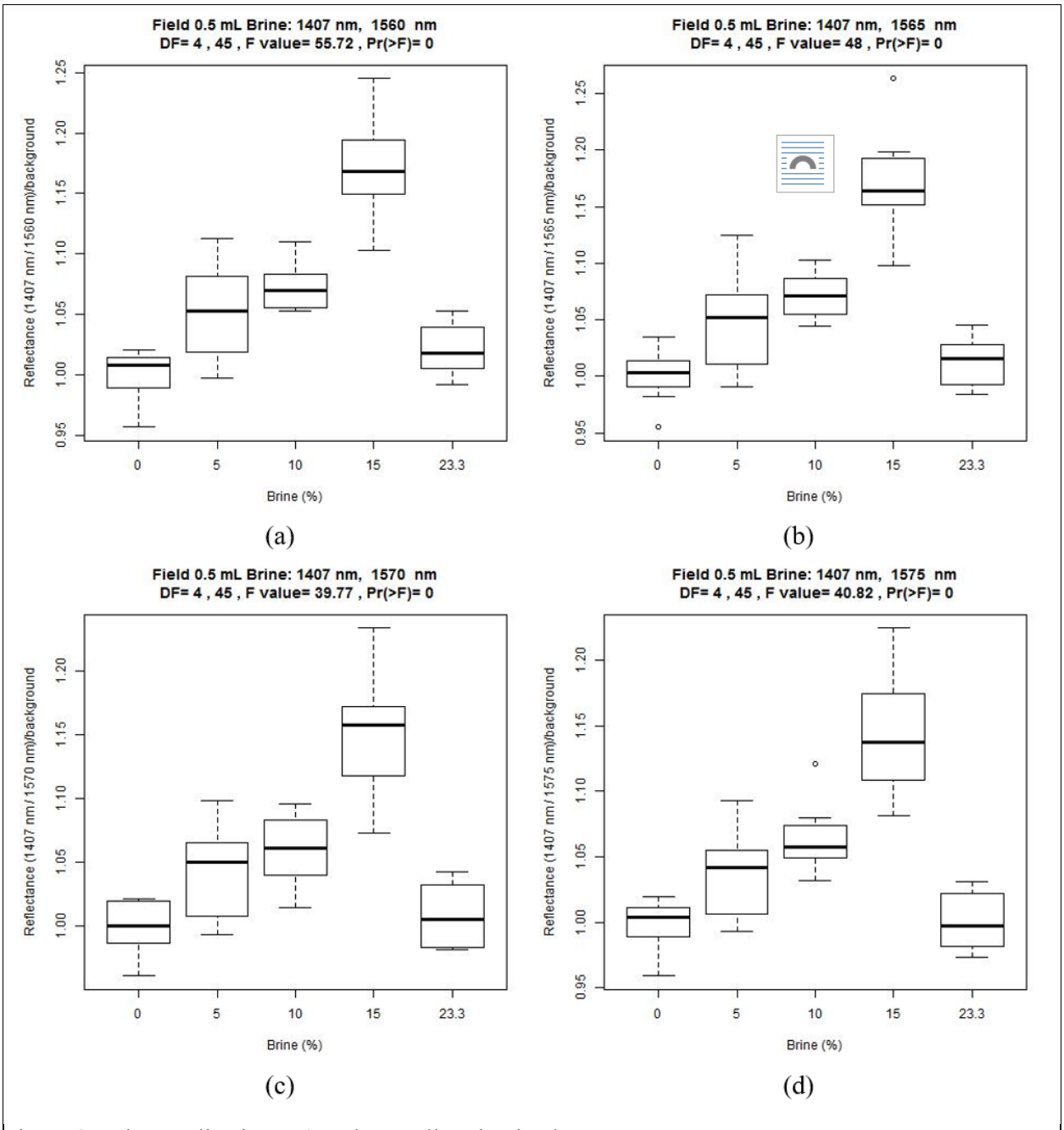

Figure 3. Brine application at 0.5ml on well-maintained pavement

Impacts/Benefits of Implementation (actual, or anticipated)	Being able to identify concentration and presence of anti-icing and deicing chemicals using spectral imaging has considerable valuable for practical applications such as winter. Monitoring concentration of anti-icing and deicing in real-time could serve to improve maintenance operation efficiency and roadway safety. The ability to detect surface presence would also be valuable for tracking the migration of these chemicals and learn more about the conditions under which these chemicals migrate within and off the roadway. This is of particular interest as salts and carbohydrates can harm wildlife and some infrastructure. UAF is actively working with Alaska DOT&PF to explore the use of mobile road weather information systems (MRWIS) to achieve similar outcomes as the hyperspectral imaging units.
Web Links • Reports • Project Website	n/a