UTC Project Information	
Project Title	Measuring Dispersal and Tracking of Anti Icing and Deicing Chemicals using In Situ Hyperspectral Data
University	University of Alaska Fairbanks
Principal Investigator	Nathan Belz
PI Contact Information	npbelz@alaska.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	University of Washington PacTrans $60,000 Alaska Department of Transportation $60,000
Total Project Cost	$120,000
Agency ID or Contract Number	69A3551747110
Start and End Dates	September 1, 2017 – August 30, 2018
Brief Description of Research Project	Over 70% of roads in the United States are located in cold and snowy regions (Federal Highway Administration, 2017). The management of anti-icing and deicing efforts during winter months in these regions is critical for mobility and safety. Snow and ice accumulation on pavement reduces roadway surface friction resulting in lower vehicle maneuverability, slower travel speeds, reduced roadway capacity, and increased crash risk. The extent to which certain chemicals and practices are effective at mitigating the effects of snow and ice are, for the most part, well understood. However, little knowledge exists on the physical processes that affect the longevity of these applications. Methods to quantify and analyze snow and ice remediation methods as well as the imposed loss of material are needed. To that end, the objectives of this research were fourfold. First create a framework and develop methods for generating an anti-icing and deicing chemical spectral library to be used for in-situ imaging and concentration quantification. This step is critical as it allows for the hyperspectral data to be classified based on key wave length signatures that have been previously identified. Second conduct field imagery acquisition and processing for proof of concept. Third develop and conduct robust sampling strategy to quantify the amount of anti-icing and deicing chemical loss due to imposed processes. Lastly use these findings to inform and improve winter maintenance 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 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.


521F

Impacts/Benefits of Implementation (actual, or anticipated)
Being able to identify concentration and location of brine and beet deicers using spectral imaging has considerable valuable for practical applications such as winter maintenance and future research such as deicer dispersion and tracking. Monitoring concentration of anti-icing and deicing would allow real-time monitoring to ensure adequate deicing concentrations. As a result, road maintenance crews can avoid conditions where a deicing chemical becomes too diluted and cannot function as intended, possibly refreezing the surface ice making winter roadways more dangerous. Accurate measurements of anti-icing and deicing chemicals would facilitate safer winter roadways as well as more effective use of state materials used to maintain safety and reduce operating budgets. The ability to track and locate surface presence would also be valuable for tracking migration and learn more about the methods by and quantities at which these chemicals migrate within and off the roadway. This is of particular interest as salts and carbohydrates can harm wildlife and some infrastructure. Additional research is currently being planned 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: in review
Project Website: in development