CENTER FOR TRANSPORTATION RESEARCH

0-7007 Weather-Responsive Management Strategies

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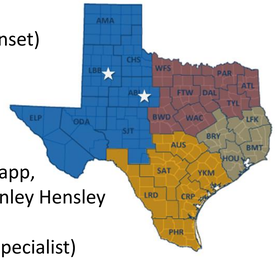
Allow TxDOT to track **winter weather operations** on the roadway. Demonstrate valuable ways TxDOT can access data to improve safety and effectiveness.

Objectives

Main project activities:

- ✓ Setting up and piloting winter operations sensing
- ✓ Evaluating other sensors (Mobile IceSight, Sadeem, Onset)
- ✓ Advanced data analysis
- ✓ Finding workflows to utilize new technologies
- ✓ Presenting reports and workshops



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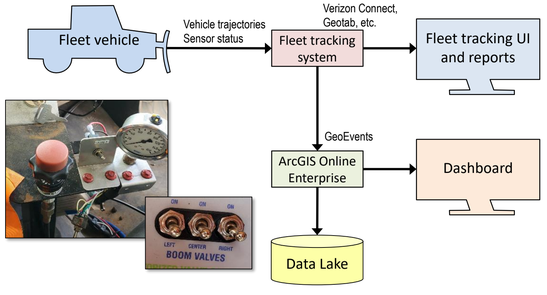
Abilene (Daniel Richardson – Dir. Ops, Gary Shelnutt – Specialist)
Lubbock (Mike Stroope – Dir. Maint., Jeremy Dearing – Dir. Ops.)

Architecture

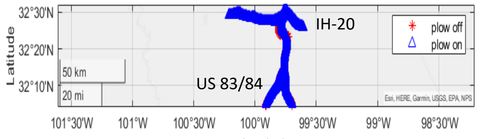


- Leverages TxDOT's enterprise fleet tracking system
- Fully passive to the vehicle operator
- Exemplifies **ArcGIS Online** that runs **TxERA**
- Utilizes **live and historic data** along with GIS layers

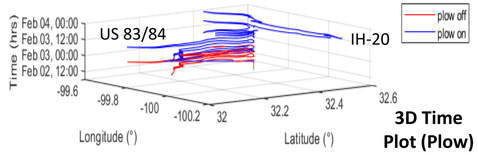
Vehicle Location and Activity

Fleet vehicle tracking in Abilene

- Both plots show where the vehicle has been and where/when plowing occurred.
- Key corridors plotted are IH-20 E-W, and US 83/84 N-S.
- Tracks may be overlapping on the 2D plot.
- 3D plot shows time increasing upwards, Feb. 2-4, 2022.



2D Plot (Plow)



3D Time Plot (Plow)

Brine Logging Semi-Automation

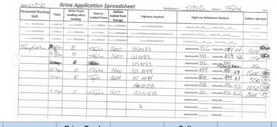
Semi-automation

Brine logs were compared with GPS tracks for Jan. and Feb. 2021 winter weather.

Several discrepancies were observed which include:

- ➢ Inaccuracies in times and mile markers
- ➢ Evidence of rounding-off
- ➢ Difficulties in understanding notation consistently

Automated reports can resolve these.



Personnel Working	Time	Brine Truck Reading When Loading	County Loaded Form	Gallons Loaded From Storage	Highway Applied	Highway Reference Markers	Gallons Sprayed
9LK45G	Tue Mar 01 2022 22:16:20 GMT-0500 (Eastern Standard Time)	0	Taylor	1600	FM3438-KG	Beginning MM 1, Ending MM 1	1600
9LK45G	Tue Mar 01 2022 22:16:27 GMT-0500 (Eastern Standard Time)	0	Taylor	1600	IH0020-KG	Beginning MM 291, Ending MM 292	1600
9LK45G	Tue Mar 01 2022 22:17:15 GMT-0500 (Eastern Standard Time)	0	Taylor	1600	US0083-KG	Beginning MM 309, Ending MM 309	1600
9LK45G	Tue Mar 01 2022 22:18:01 GMT-0500	0	Taylor	1600	BU0083D-KG	Beginning MM 2, Ending MM	1600

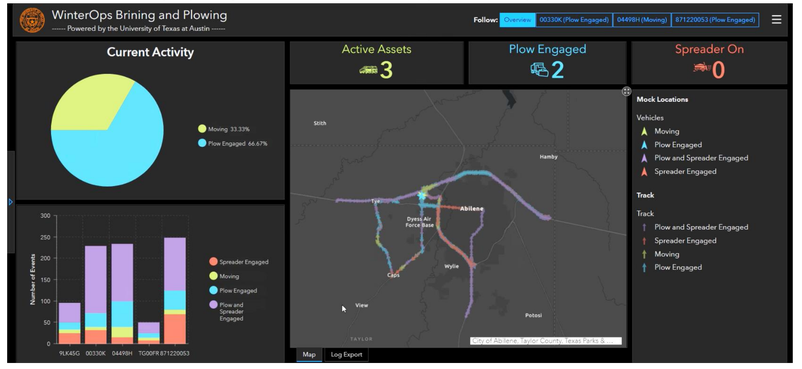
Visualization opportunities

With weather precipitation data, discern when de-icing agent needs to be re-applied:

- ➢ **"Breadcrumbs"** that fade away after a few days
- ➢ Incorporate effects of **historic precipitation**
- ➢ Replenishment optimization
- ➢ Helpful for reviewing selective treatments; e.g. **bridges and hills**
- ➢ Identify places where treatment may have been missed

Dashboard

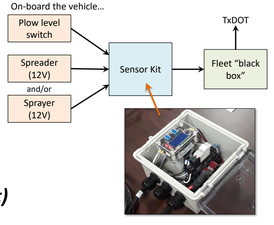
The dashboard displays **key stats**: live & historic operation, equipment state, vehicle tracks.



Sensor Kit Installation Overview

How to get this running in your district:

- ✓ Order sensor kits. (1-month lead time) ***(CTR can assist)***
- ✓ Choose target vehicles ***(TxDOT District)***
- ✓ Upgrade "black box" telemetry devices if needed ***(TxDOT)***
- ✓ Order cable harnesses (~1 mo.) ***(CTR can assist)***
- ✓ Install sensor kits. ***(CTR can assist)***
- ✓ Verify signals in shop. ***(CTR can assist)***
- ✓ Perform simple road test and verify signals ***(CTR can assist)***



Research Progress

- Applying to **other types of fleet operations** (e.g. vegetation, incident response, repaving)
- Finding starts and ends of **"missions"**
- Reporting **cumulative treatment** over a period of time/month/season
- Tracking effects of **weather and time** on pretreatment activities
- Understanding treatment patterns on roads & **"missed spots"**
- Modeling and predicting **road ice formation**