The Effects of Residual Chemical on the Road During Blowing/Drifting Snow Events

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Outline

- Problem Statement & Objective
- Blowing Snow & Residual Chemical
- Instrumentation
- Methodology
- Preliminary Findings
- Ongoing & Future Work

Problem Statement & Objective

- **The interaction between residual chemicals and blowing snow can present a serious safety hazard for motorists and decision making difficulties for maintenance personal.**
- **Current field project investigate this interaction in a controlled setting.**
  - Test segment selected
  - Instrumentation used to validate effects

Residual Chemical

- Blowing snow conditions can last for extended periods of time following snowfall event leading to the conclusion that blowing snow is the number one cause of road ice formation (Tabler, 2004)
- Chemicals are spread for deicing and anti-icing purposes
- Any residual chemical can lead to icing situations
- Chemicals can also produce an ‘ice cream freezer’ type affect

Blowing Snow

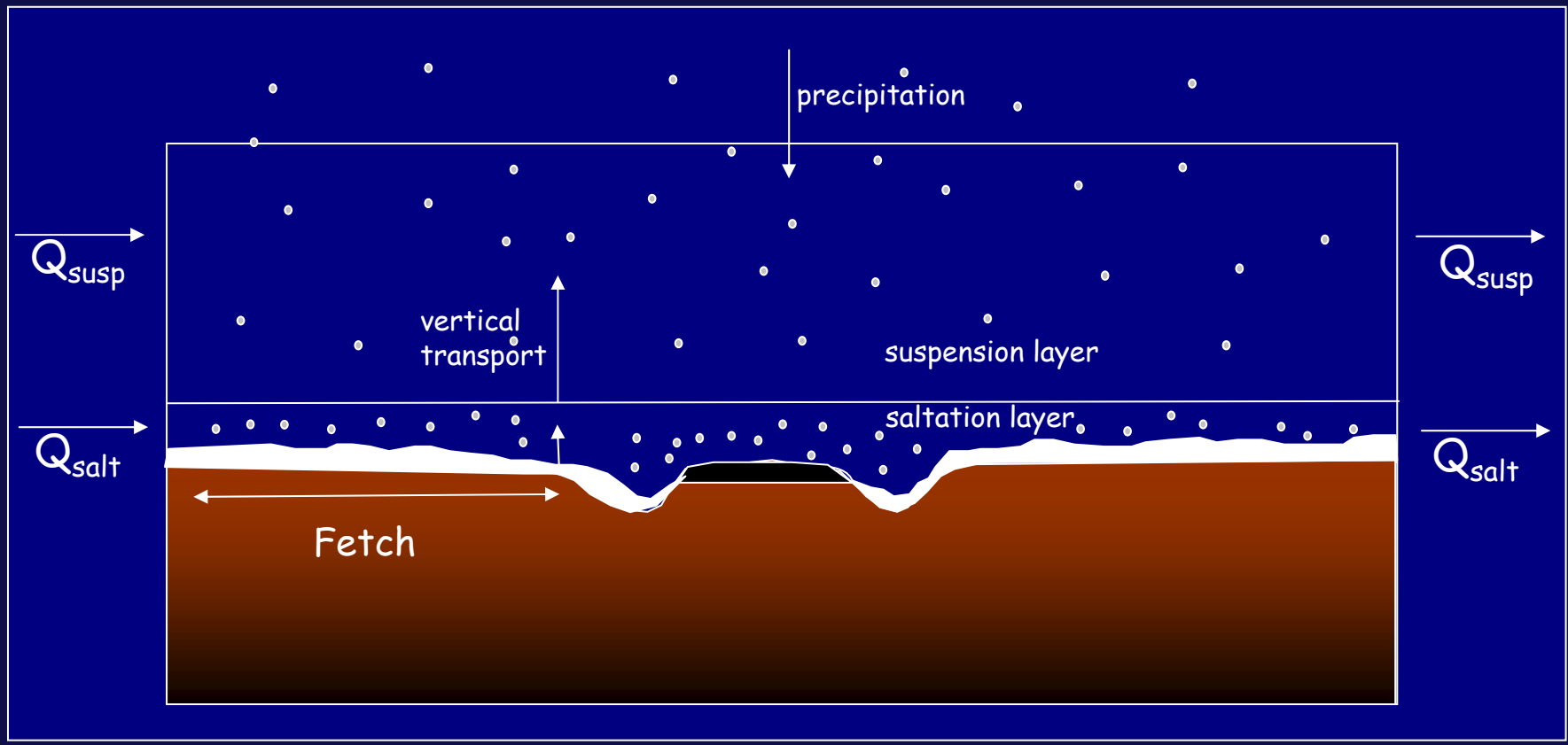


Image Courtesy of Leon Osborne

Blowing Snow

- **Occurs in 3 different phases (vertical height)**
  - Rolling < 0.01 m
  - Saltation 0.01 m to 0.1 m
  - Suspension 0.1 m to 100 m
    - Note that rolling particles can also be classified as saltation particles
- **Blowing snow affects the pavement heat balance**
- **The mass flux of blowing snow on the roadway can exceed the highest mass flux amounts of falling snow (Tabler, 2004)**
- **Roadway visibility is typically calculated at 1.2 m because the average non-commercial vehicles viewpoint is this high (Matsuzawa and Takeuchi 2004).**

Instrumentation

All data are collected from the UND Road Weather Field Research Facility just north of Buxton, ND along I-29.

- **3 disdrometers located at:**
  - Cam #1: 0.4 m; lowest level possible
  - Cam #2: 1.2 m; typical driver height
  - Cam #3: 2.1 m; close to commercial vehicle height

- **Other instruments used:**
  - Sonic Wind Anemometer
    - Met One Instruments, Inc. 50.5H
  - Temperature/RH Sensor
    - Vaisala HMP45C
  - Luft Pavement sensor
  - UND pavement sensor
  - Salt Quantity Meter SOBO 20

Instrumentation (cont'd)

- **The three disdrometers used for this research are known as the Video Snowflake Imager (VSI)**
  - Donated by NASA
  - Hardware consists of flood lamp, camera & housing, and PC **Camera Specifications**
  - ~ 60 frames per second
  - 640 x 240 pixels per image
  - Calibrated to yield 0.05 mm x 0.1 mm resolution
  - Viewing window is 32 mm x 24 mm
- **Custom software was developed to process the image files**

Images courtesy of Dr. Larry Bliven

Instrumentation (cont'd)

- **SOBO 20 roadway salt quantity Instrument**
  - Loaned to STWRC by Iowa DOT
  - Ability to measure quantity of both NaCl and $CaCl_2$
    - Conductivity of each chemical is virtually the same
  - Uses water and Acetone to measure conductivity
  - Measurements are in g/m^2
  - Contains a setting of ½ and 1 to provide more accurate measurements in situations with low chemical concentrations

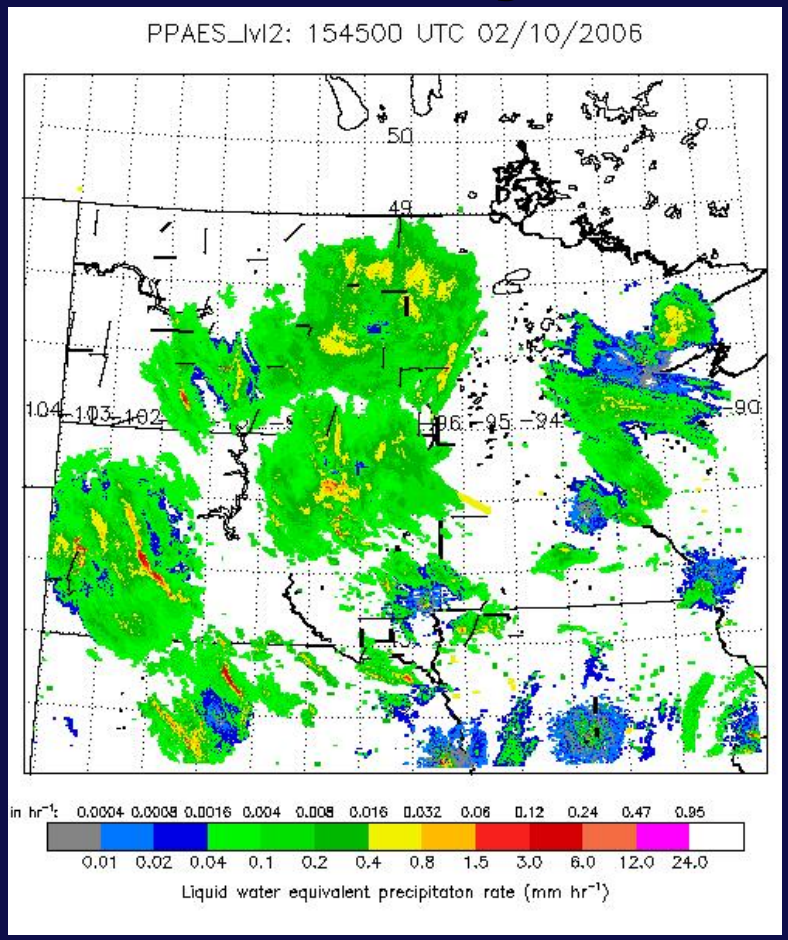
Methodology

- Establish a test roadway segment (10’ x 28’)
- Apply NaCl/Sand mixture to segment at an application rate of 1000lbs/lane mile (1 lb)
- Chemical composition was 50/50 by volume
- Take initial readings with SOBO
- All other instrumentation is continuously collecting data.
- After the passage of blowing snow event more SOBO measurements performed

Case Study

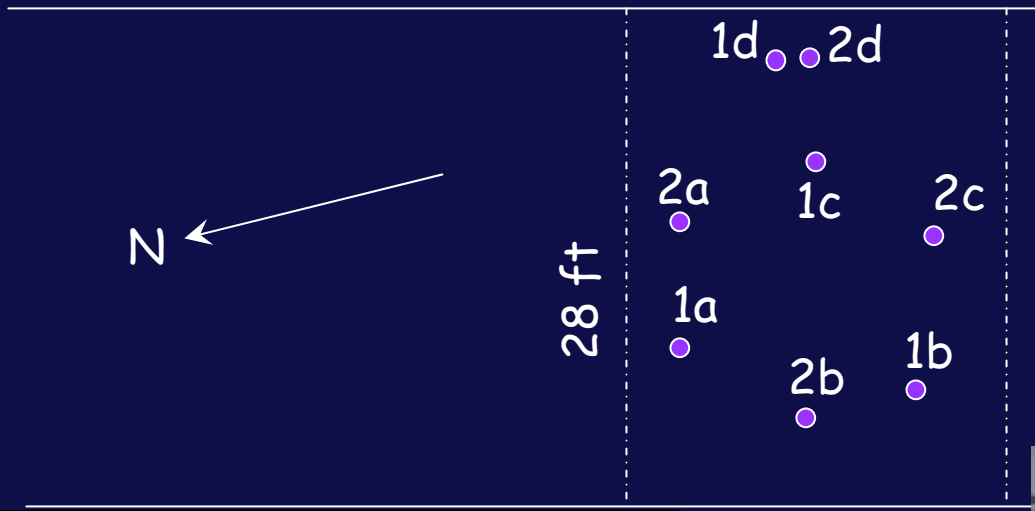
- 21 UTC on Feb. 8th to 21 UTC on Feb. 10th 2006
- Weather conditions the morning of the 10th presented the Red River Valley with a blowing snow event
- Analysis of both atmospheric and pavement conditions are performed
- SOBO measurements were taken in the aftermath of the blowing snow event on the 10th

Case Study



PPAES output from the morning of Feb. 10th

Roadway Segment Layout



1 a-d Feb. 8th 21 UTC

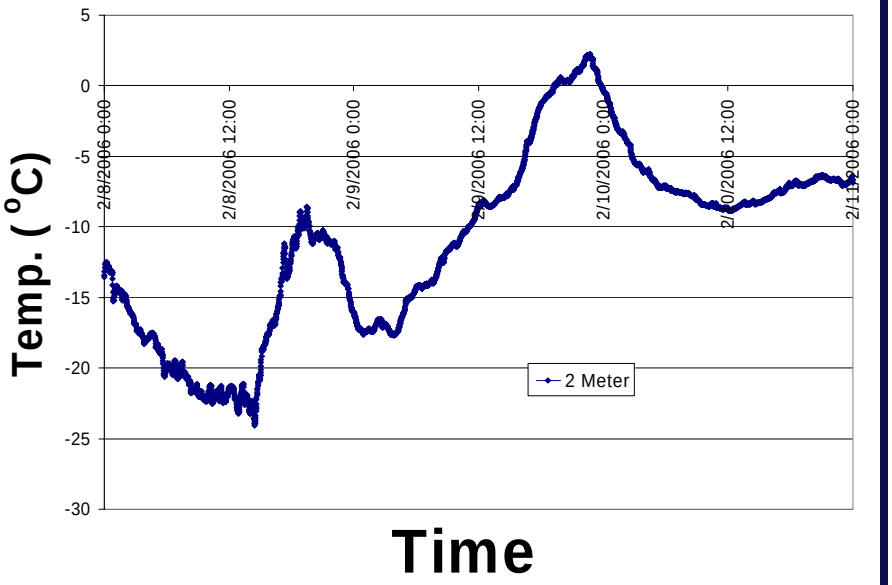
2 a-d Feb. 10th 21 UTC

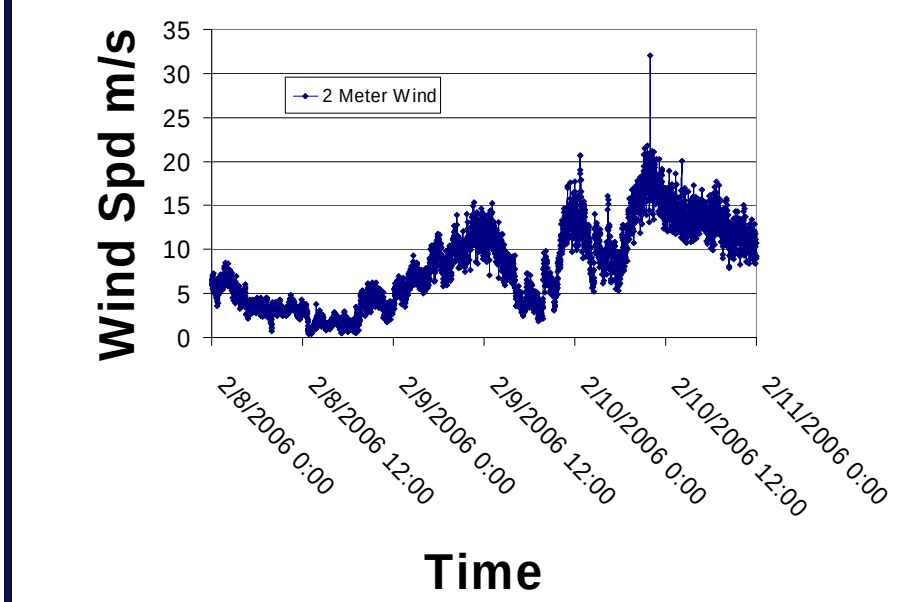
Feb 8th			Feb 10th	
a	0		a	1
b	0		b	0.5
c	4-5		c	1.5
d	2		d	0.5

SOBO setting of 1/2

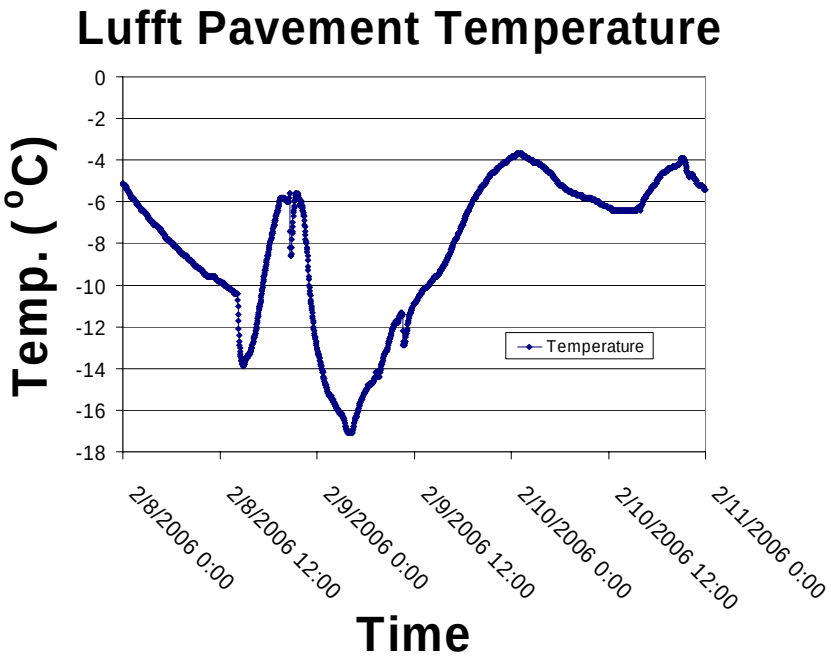
Actual test segment image

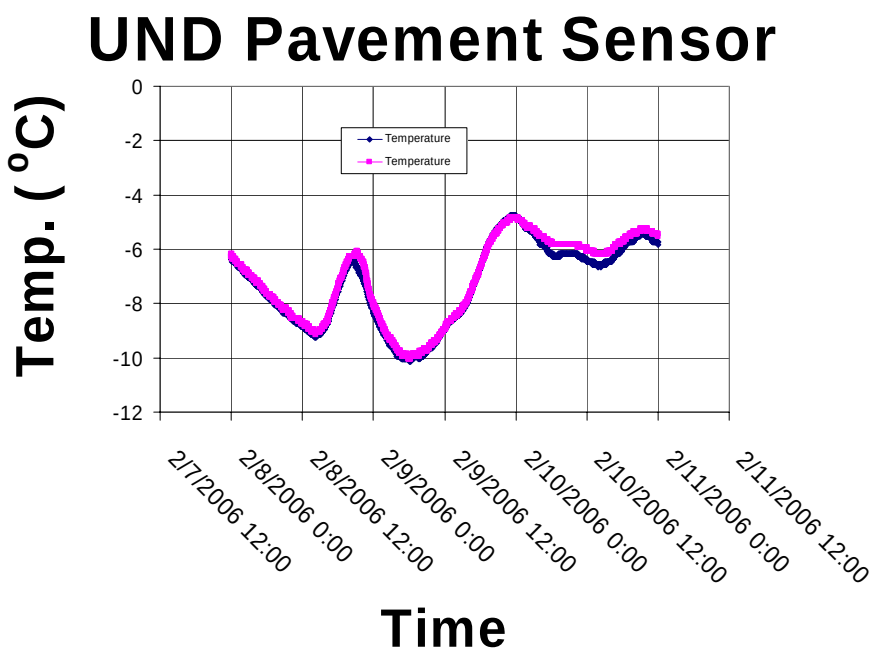
Atmospheric Data





Pavement Conditions





Conclusions

- **Even with small amounts chemical left, blowing snow can build on the road causing slippery conditions**
- **Adjacent untreated road stayed snow/ice free**
- **Data collection during a winter storm event can be difficult**
  - Data dropouts
  - Overall weather conditions
  - Timing of event

Continuing Research

- Provide time lapse video of test segments
- Conduct more case studies during the winter of 2006-07
- Use different chemicals that are used on the roadway
- Create a more realistic test segment with known vehicle traffic
- Use addition data from the newly acquired friction wheel from the Ohio DOT
- Improved data analysis for blowing snow deposited on the roadway

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Thank You!

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