Performance Metrics and Tools for Winter Maintenance Operations

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0. CONTENT

1. INTRODUCTION

Substantial strides have been made in measuring resource utilization

- However, measuring the effectiveness and efficiency of winter maintenance is much more difficult

- Variability in weather conditions, resource constraints, and expected level of service all have significant impacts on resource utilization

Effectiveness is traditionally measured by:

- Setting level of service goals and measuring their under- or over-achievement

- Developing winter severity indices to account for variability in weather conditions

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1. INTRODUCTION

Problems that impede these attempts to normalize resource utilization data for these varying factors include:

• Quantitative measurement of road conditions is notoriously difficult

• Weather severity indices typically oversimplify relationships

• When developed using an agency's historical data, may not apply to other agencies that serve different constituencies

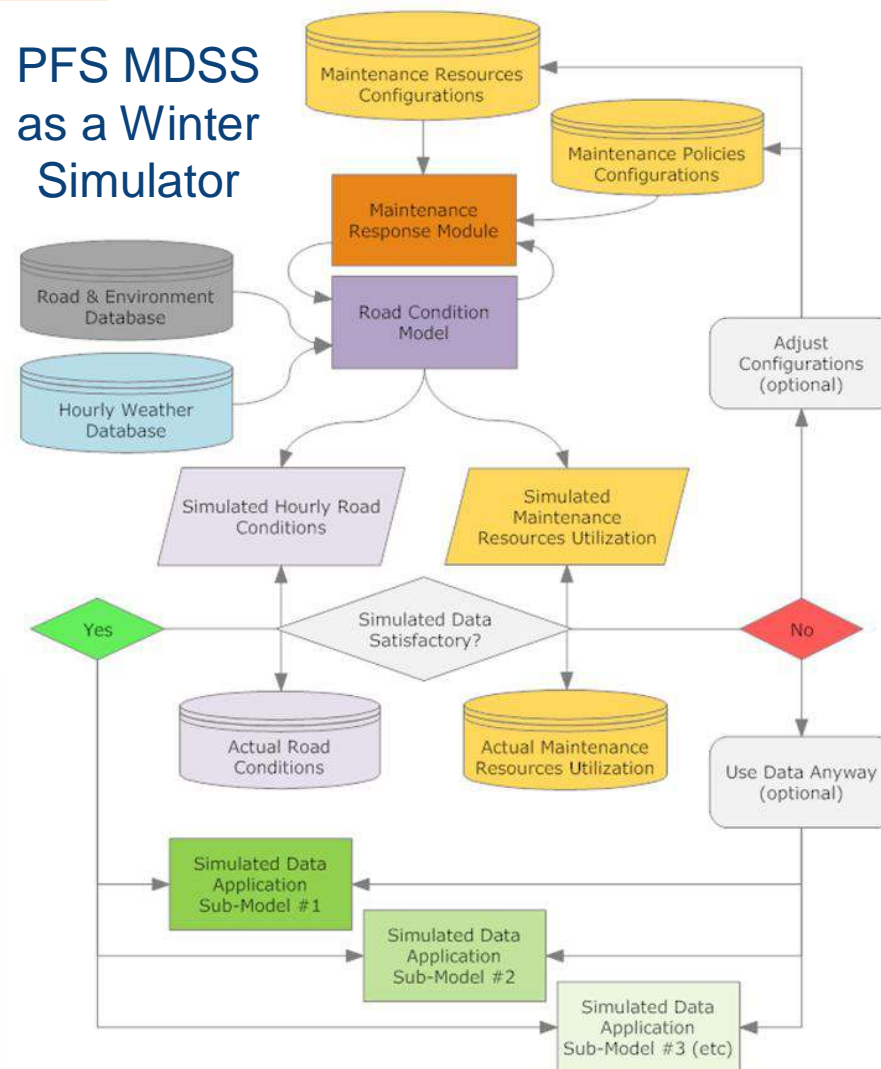This paper presents some potential solutions to these problems.

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2. Model-Based Approaches to Quantifying Winter Severity

Complex winter simulation models permit the ability to control for a wide range of complicating factors.
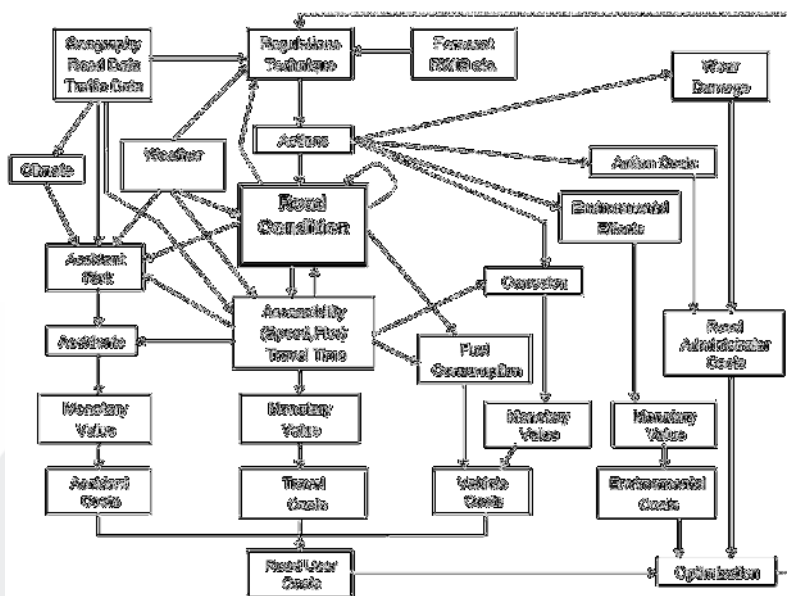
PFS MDSS as a Winter Simulator

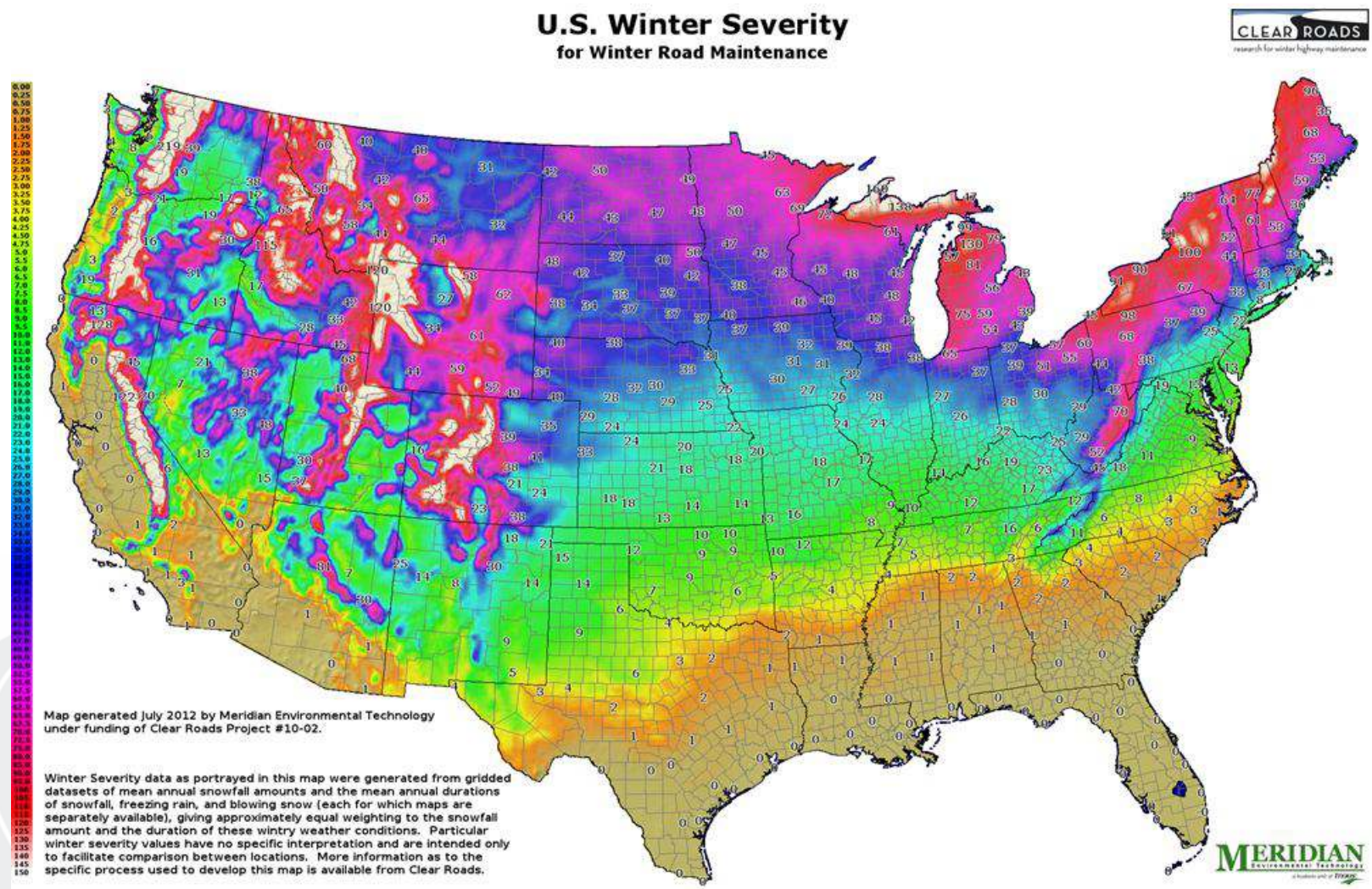Winter Model

3. Issues with Weather Data Resources

Observations from weather stations or agency personnel are the most common basis for calculating winter severity measures.

Upon closer look, there is a disturbing level of variability in how different sensors respond to the same weather conditions

• This isn't necessarily a significant issue if evaluating resource utilization against a single weather station over time, but…

• …it is probably <u>severely</u> impacting any applications of winter severity measures that attempt to look at weather variations spatially.

One possible solution: **Weather Forecast Models**

3. Issues with Weather Data Resources: A Blended Approach

U.S. Winter Severity for Winter Road Maintenance

4. Quantification Tools

5. Real-World Examples: Actual vs. Simulated Salt Usage

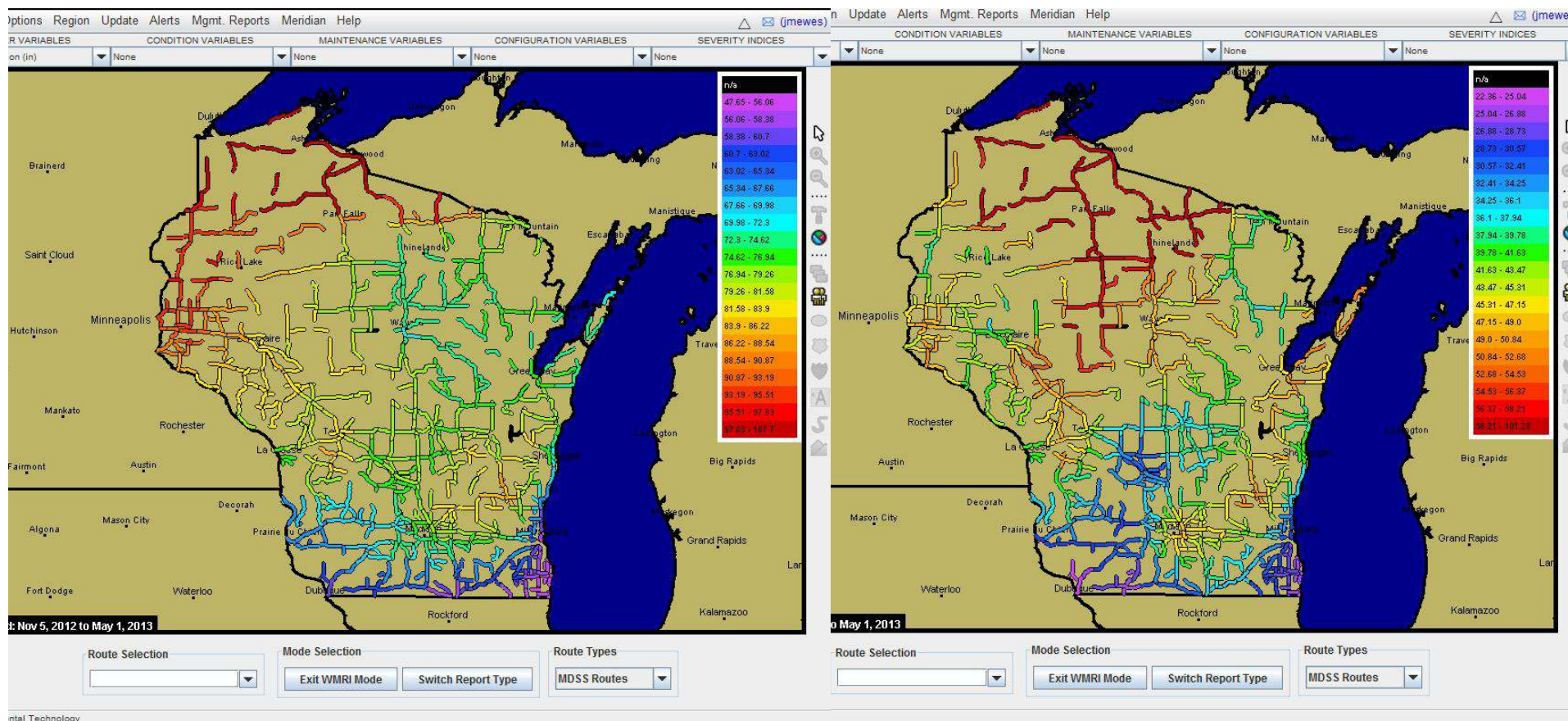## Actual vs. Simulated Salt Usage on I-93 in New Hampshire
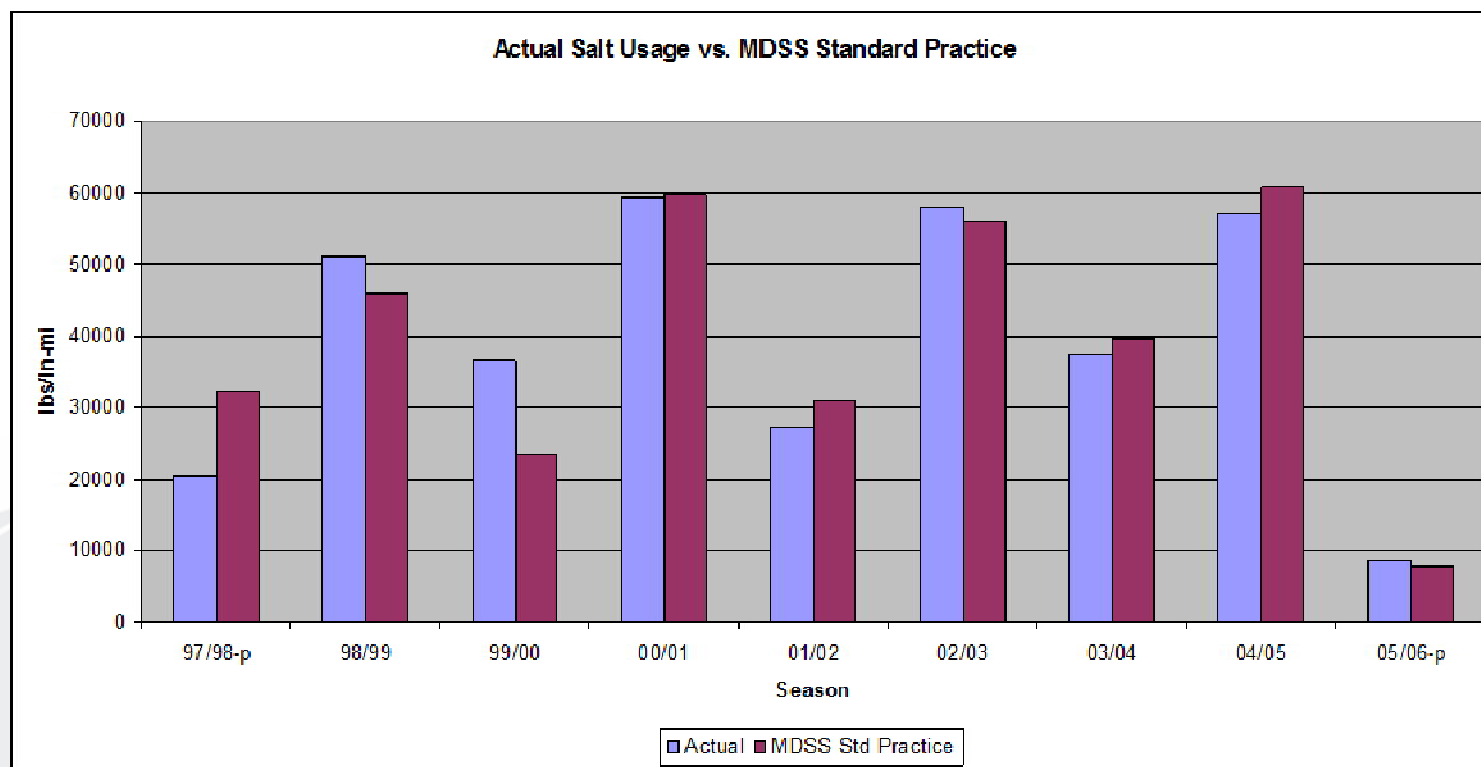
5. Real-World Examples: Impact of Weather Data Used

Seasonal Snowfall Estimates for the State of Wisconsin

Forecast Weather Data
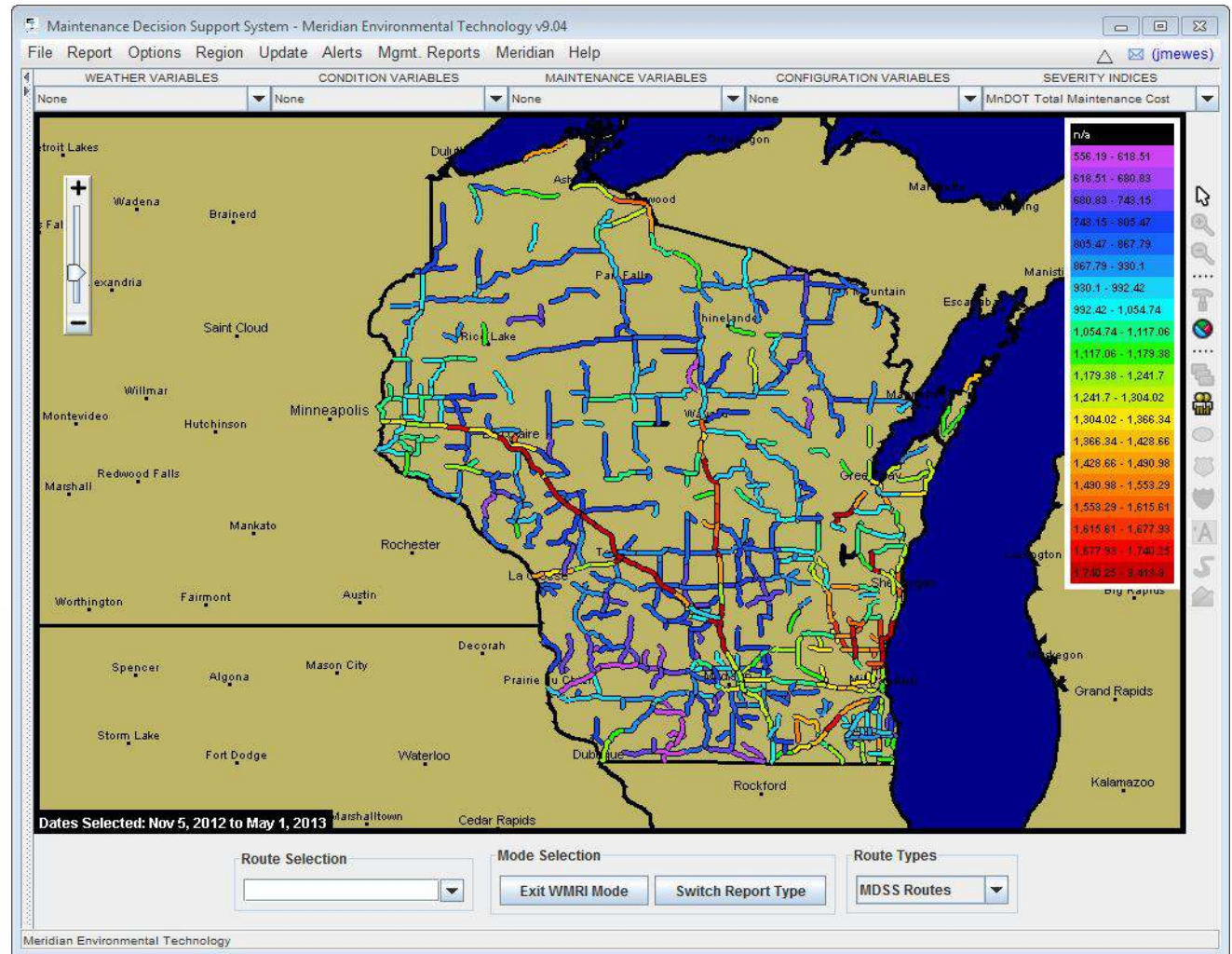
Observed Weather Data

5. Real-World Examples: Importance of Level of Service & Traffic

Simulated Winter Maintenance Costs

Note that higher volume roads & the more urban eastern areas of the state are simulated to have higher costs

5. Real-World Examples: An Agency-Wide Look Over a Season

SDDOT Agency-Wide Comparisons
Using "Analysis" Weather Data (100=$566)

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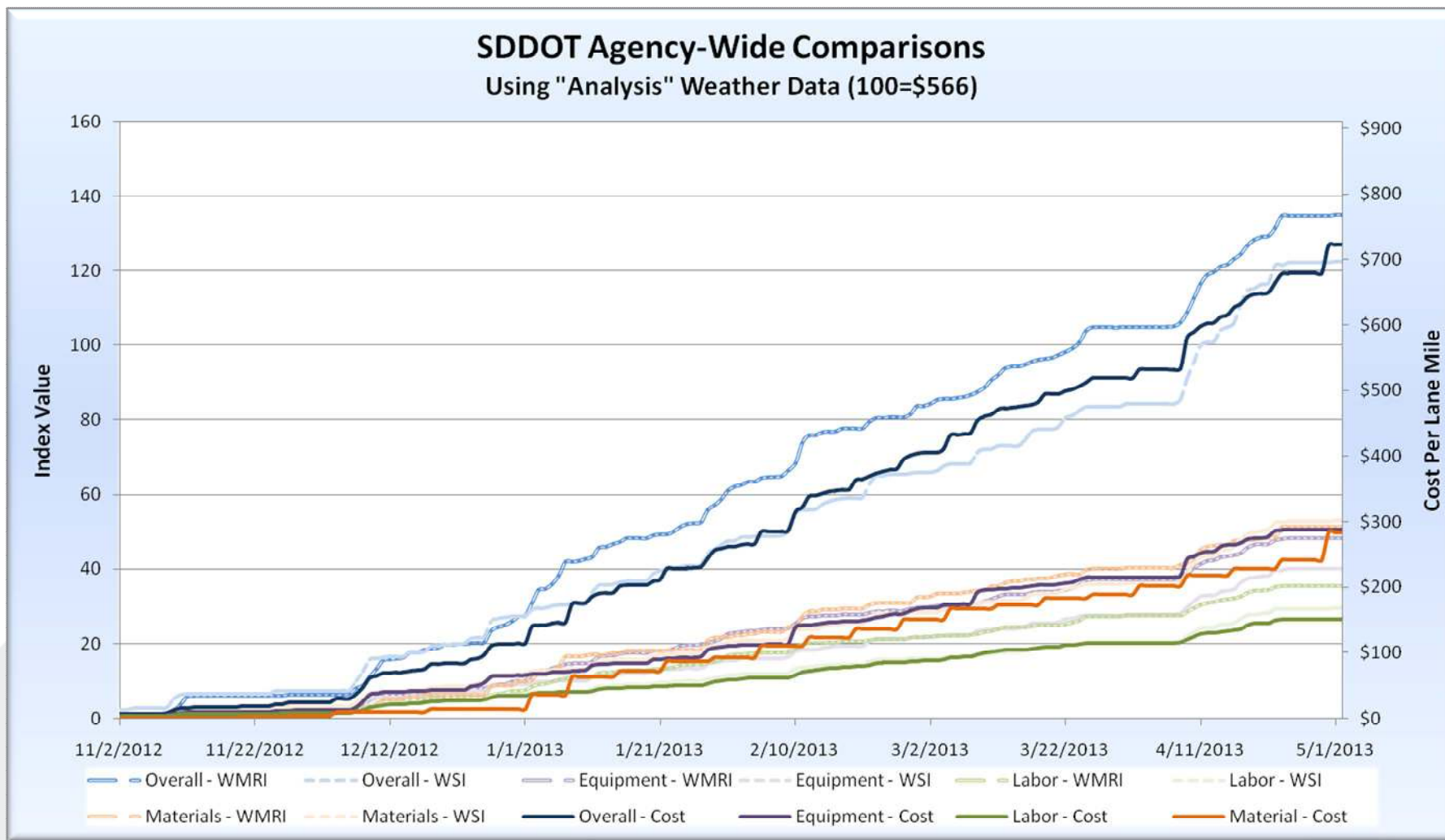
6. Summary / Conclusions

• Sophisticated model-based tools hold considerable promise for better understanding the complex relationships between weather, environments, traffic, and maintenance policies / practices

• Using a model-based approach permits the development of performance metrics that control for 'outcomes', i.e. that are reflective of the fact that some roads require more intensive maintenance activities than others

  • Can also permit re-use of the same approach across jurisdictional boundaries, permitting comparisons against peer agencies with differing weather or other complicating factors

• It is vitally important to understand the nuances of the weather data that is being used, and how it impacts the reliability of the resulting metric.

  • This is especially true when comparing data from different locations, using data from differing weather stations