

MDSS Functional Prototype Development Status – April 2002



Presented by

Bill Mahoney

National Center for Atmospheric Research

(NCAR)



Overview – MDSS Project Schedule

FY2000: Requirements Analysis
Technology Review by Labs

FY2001: Conceptual Prototype Development
(storyboard concepts & user feedback)

FY2002: Functional Prototype Development
Demonstration
Documentation
Technology Release

Overview – MDSS Project Schedule

FY2002:

**Functional Prototype
Development:**

October – May '02

System Demonstration:

**15 April '02 (web based)
13-14 June '02**

MDSS Documentation:

July-August '02

**Technology Release:
Release #1**

September '02

MDSS Development Status

The primary objective in FY2002 was to move from conceptual framework toward a functional framework.

An early version of an end-to-end functional prototype MDSS has been successfully coded!

The MDSS FP, as coded to date, will be demonstrated today.

MDSS Development Status

Stated Objective:

To utilize state-of-the-art atmospheric science and engineering approaches to address and improve the performance of the road maintenance practitioner.



This objective has been met.

MDSS Development Status

Stated Goals:

These goals have been met.

- Capitalize on existing road weather data sources.
- Augment data sources where they are weak.
- Fuse data to make an integrated and understandable presentation of road conditions.
- Provide diagnostic and prognostic information.



MDSS Development Status

Stated Goals
(continued):

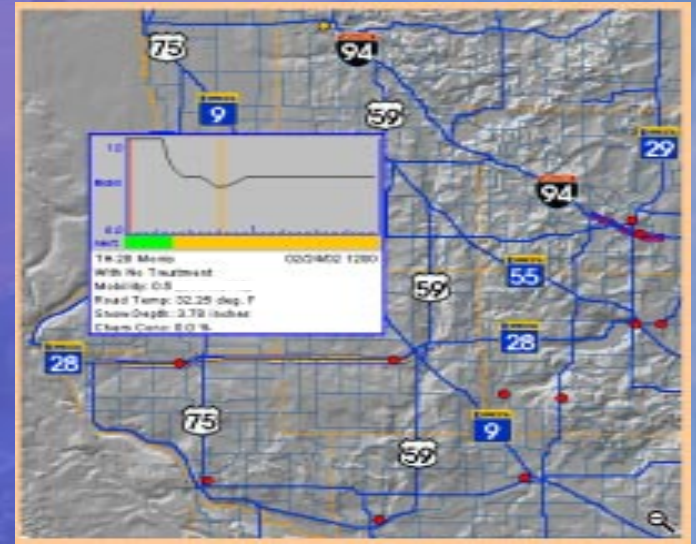
These goals have also been met.

- Provide display capability for the condition of the roadway.
- Develop a decision support tool that provides recommendations on road maintenance courses of action together with anticipated consequences of action or inaction.
- Provide all the above on a single display platform.

MDSS Development Status

Specific Winter Maintenance Decisions Supported by the MDSS FP:

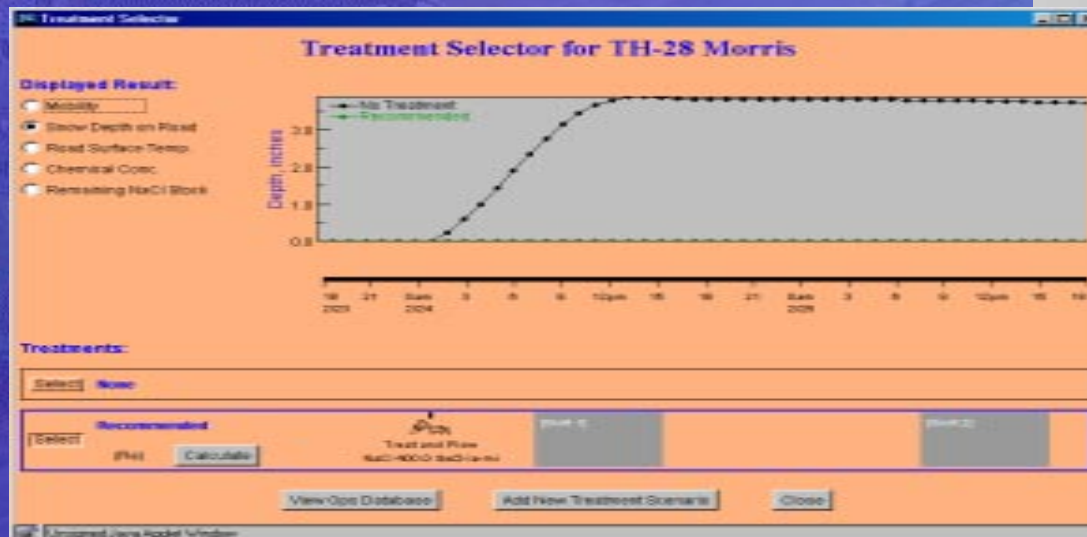
- Alert Crews
- Identify Chemicals
- Load Chemicals
- Dress Equipment
- Mobilize Crews
- Treatment Type (Chemical, Plow, Sand, etc.)
- Treatment Amount (lbs/lane mile)
- Treatment Location (routes)
- Treatment Timing (start)



MDSS Development Status

Additional Winter Maintenance Decisions Supported by the MDSS FP:

- Crew Scheduling
- Road Closure
- Cleanup (end of event)



MDSS Development Status

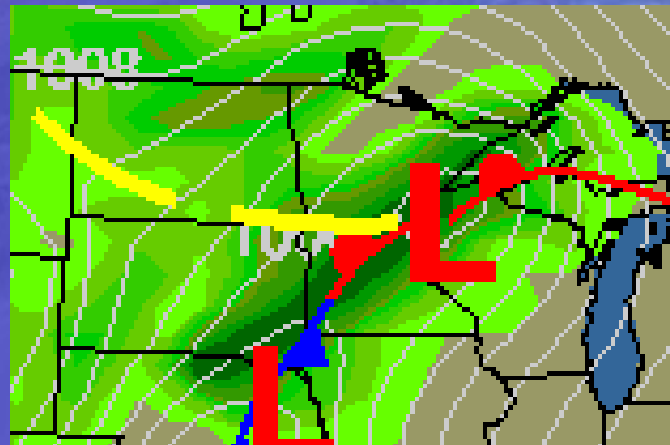
In order to support these maintenance decisions, the following must be predicted out to 48 hrs:

Weather

Precip Type
Precip Rate
Air Temp
Wind Speed
Wind Direction
Humidity
Cloudiness
Event Start
Event Stop

Road Condition

Road Temp
Road Chemical Conc.
Snow Accumulation
Ice Accumulation



MDSS Development Status

In order to predict these parameters, the following technologies were selected and reapplied:

Road Weather Forecast System (RWFS) - NCAR

Rules of Practice Module – CRREL & LL

Road Chemical Concentration Algorithm - CRREL

Ensemble Weather Forecasting System - FSL

Road Mobility Algorithm – CRREL & LL

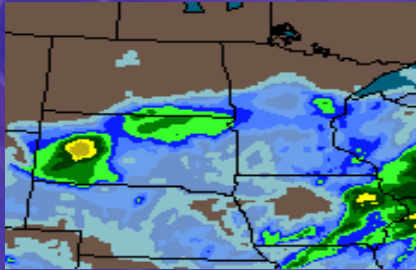
Mesoscale Weather Models
FSL/NSSL

Road Surface Temperature Algorithm - CRREL

Precipitation Type Algorithms - NSSL

Eight primary components

MDSS Development Status



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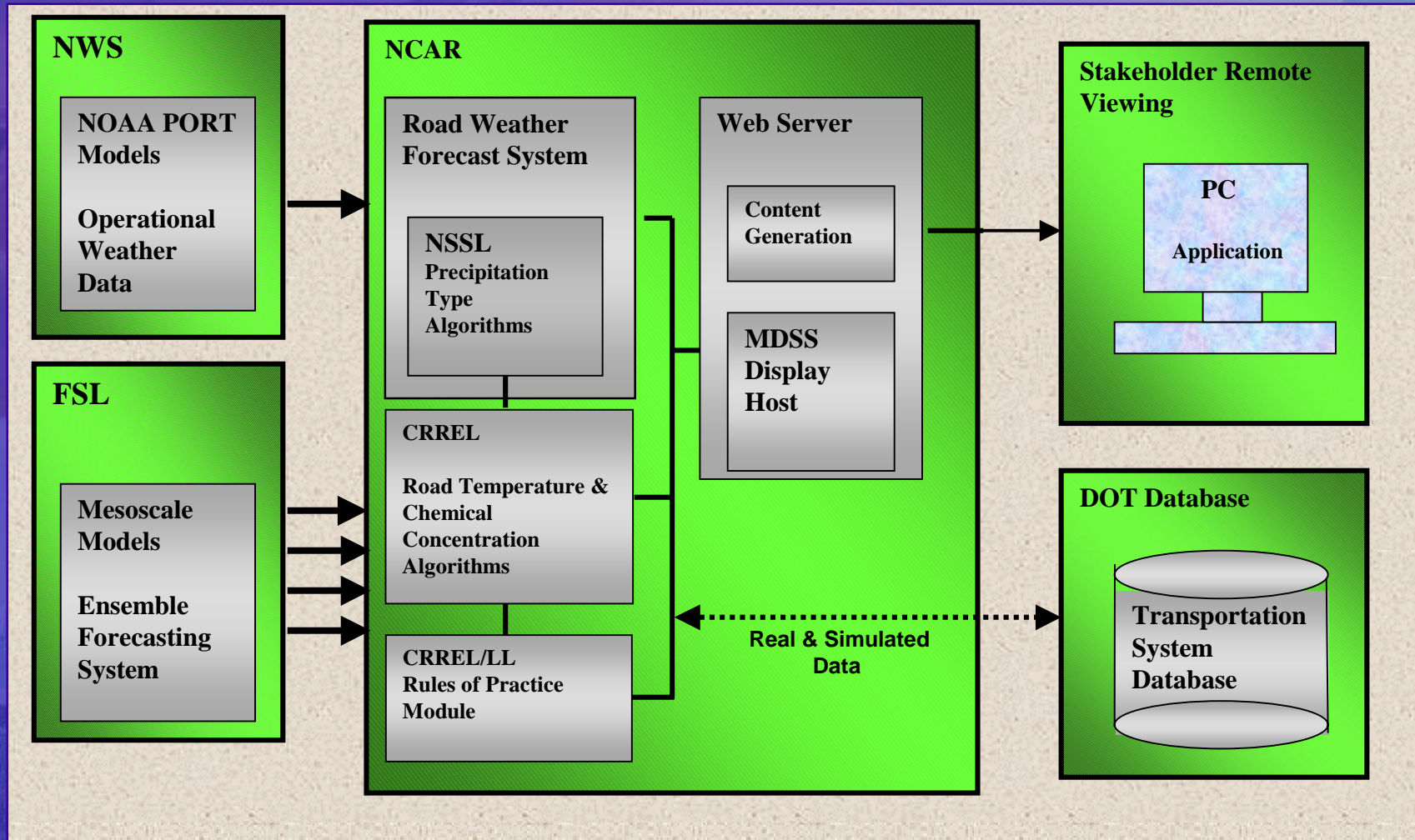
Environmental

Transportation

Operational

Decision Support

MDSS Development Status



***MDSS Prototype Components
Now Integrated & Coded!***

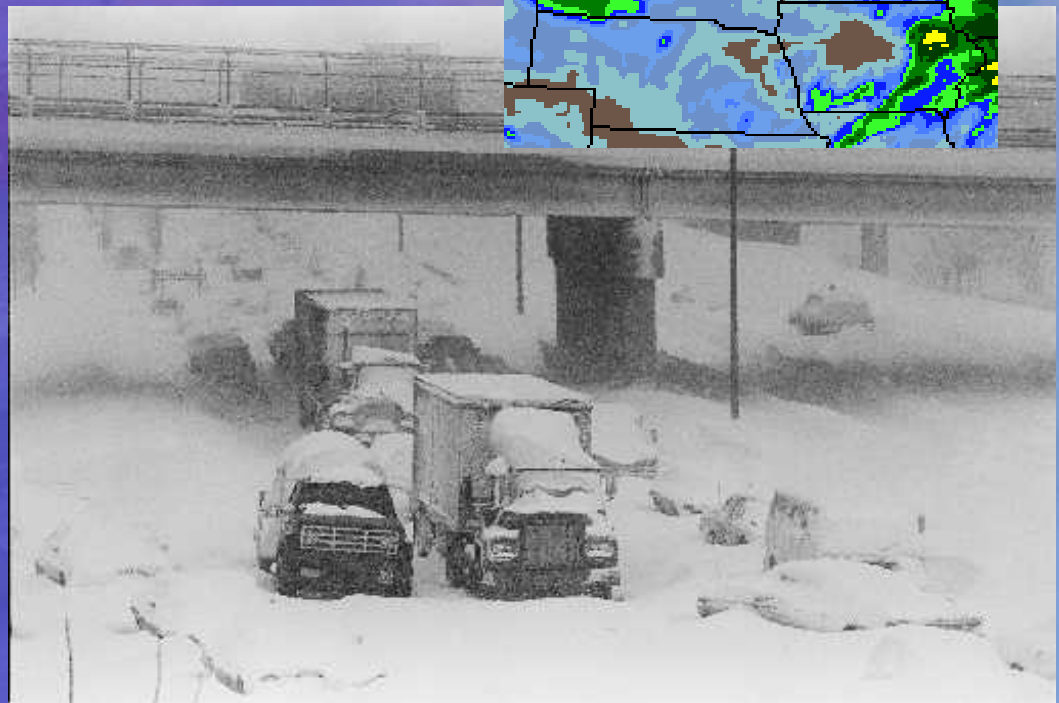
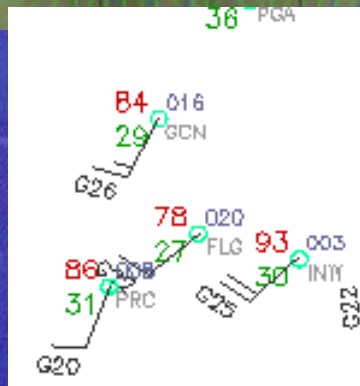
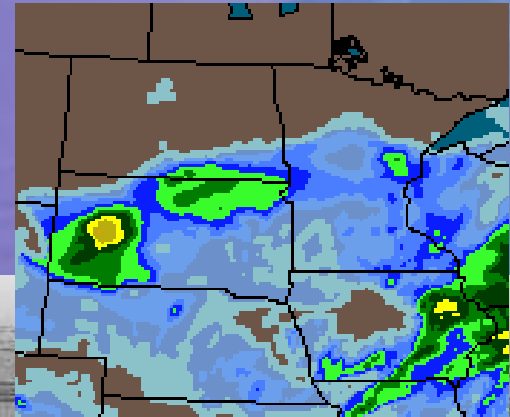
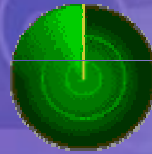
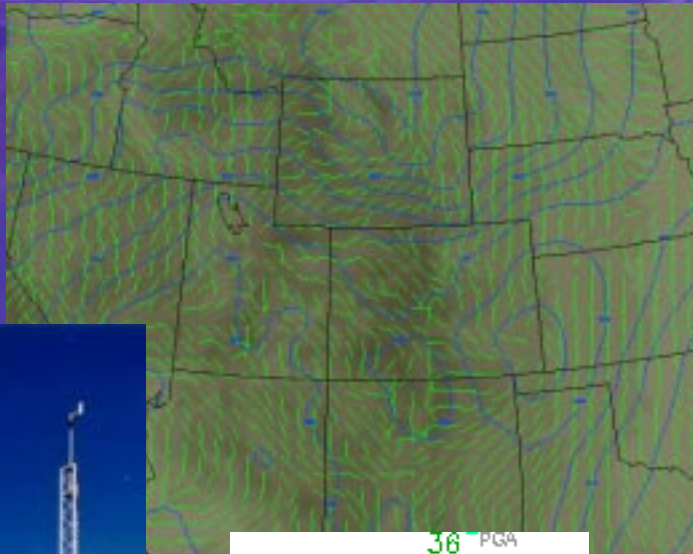
MDSS Development Status

The screenshot displays the MDSS software interface, which is used for defining treatment scenarios and monitoring road conditions. The interface is divided into several panels:

- Select Treatment Panel:** Allows users to define a treatment scenario by selecting a material (NaCl, MgCl, or Sand), an amount (e.g., 25 lbs / 2-lane mile), and a start time (e.g., 18:00 Hrs). A list of treatments is shown, including NaCl at 125 lbs / 2-lane mile at 18:00, NaCl at 100 lbs / 2-lane mile at 22:30, and Sand at 175 lbs / 2-lane mile at 6:00.
- Morris Area Road Conditions Panel:** Displays current time (02/26/2004 19:46) and weather alerts. A color-coded legend indicates road conditions: Extreme (red), Poor (orange), Marginal (yellow), and OK (green). A map shows the Morris Area with various roads (e.g., 75, 94, 59, 29, 28, 9) and a weather alert for TR-28 Morris, indicating a recommended mobility of 1.0 (normal N), road temp of 30.4C (avg. F), snow depth of 0.0 inches, and a clear count of 2.04 %.
- Treatment Selector for I-94 Alexandria Panel:** Shows a graph of Depth (inches) versus Time (hours) for different treatment alternatives. The graph displays three curves: No Treatment (black), Recommended (green), and Alternative 1 (blue). The Recommended curve shows a rapid increase in depth, while Alternative 1 shows a much slower increase. The graph also includes a 'Displayed Result' section with radio buttons for 'Moistly', 'Show Depth on Road', 'Road Surface Temp.', 'Chemical Cost', and 'Remaining NaCl Stock'.
- Treatments Panel:** Lists available treatments, including 'None', 'Recommended' (NaCl 175.0 lbs/2-lane), and 'Alternative 1' (NaCl 400.0 lbs/2-lane). It includes buttons for 'Select', 'Delete', 'Calculate', and 'View Ops Database'.
- Timeline Panel:** Shows a timeline of treatment events, including 'Treat and Flow NaCl 400.0 lbs/2-lane' and 'Treat and Flow NaCl 175.0 lbs/2-lane' at various times (e.g., 12pm, 18pm, 21pm, 24pm).

MDSS FP Demonstration

Work to be Accomplished Short Term



Work to be Accomplished

Remainder of FY2002

In order to successfully complete Release 1:

- Must verify and tune MDSS FP algorithms
- Must complete IOC development
 - Add additional chemical(s)
 - Expand coded Rules of Practice
 - Implement improved mobility algorithm
 - Refine confidence calculation
- Must `clean up' the code
- Must prepare documentation
- Must identify technology transfer method

Work to be Accomplished

Future Work (FY03)?

In order to claim MDSS is feasible, it is suggested that a live demonstration be performed.

A live demonstration would require:

- Code hardening (make more robust)
- New configurations for new routes, datasets, and meso-scale models
- Implementation of new road data
- Additional verification & tuning
- Integration of DOT ops data
- Training



**Future Work
Long Term**

Future Research – Longer Term

- **Expand ASHTO anti-icing rules to take advantage of detailed observations and predictions available from an MDSS like system.**

For example, the MDSS could be expanded to calculate minimum chemical treatment amounts needed to melt snow and ice. This would save stocks and help the environment.

Future Research – Longer Term

- Improve tactical winter road maintenance decision making (utilize radar, satellite, snow measuring technologies, etc.)
- More data fusion with DOT ops datasets & ITS technologies
- Integrate MDSS core capabilities with:
 - Traffic management systems
 - Emergency management systems
 - Other

Future Research – Longer Term

- Investigate use of probability based predictions for surface transportation decision making.
- Expand rules of practice to utilize more precise measurements and datasets
- Investigate utility of thermal mapping within MDSS framework.
- Assess utility of increasing the use of ESS measurements on road condition prediction.