Winter Road Maintenance Decision Support System (MDSS) Prototype Development

MDSS Component Overview

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MDSS
Prototype Components
Translation of Environmental Data to Road Condition Information

Environmental Data Grids

Road condition algorithms convert environmental data at road points

Road condition information provided at user configurable locations along the road.
MDSS Prototype Components

- Weather Data
- Advanced Weather Capabilities
- DOT Operations Data
- Road Condition Module
- Decision Support Logic
- Display
- External System Interface
MDSS Prototype Focus Areas

Weather Component Focus:

- Event start and stop times
- Surface temperature (2 m)
- Precipitation type
- Precipitation rate
- Precipitation accumulation
- Conditional probabilities
- Surface wind speed
- Surface wind direction
- Surface visibility
MDSS Prototype Focus Areas

Road Component Focus:

- Pavement temperature and trends
- Pavement chemical concentration
- Pavement friction coefficient (road mobility)
- Pavement contamination
- Snow drifting
MDSS Prototype Focus Areas

Decision Support System Component Focus:

- Monitor weather & road conditions
- Monitor probability & intensity of weather threat
- Treatment options & timing
- Crew scheduling & managing crew shifts
- Dispatch crews to treat roadway
- Post event clean up
Nine primary modules in FY2001

- Ensemble Forecasting - FSL
- Video Camera Image Processing - LL
- Maintenance Decision Support System - Core
- Road Weather Forecast System - NCAR
- Road Chemical Concentration - CRREL
- Road Friction Coefficient - CRREL
- Road Surface Temperature - CRREL
- Snow Drifting Algorithm - CRREL
- Rules of Practice Module - CRREL
- Precipitation Type - NSSL
Engineering Components for MDSS FY2001

Road Weather Forecast System - NCAR

- Forecast Module A
- Forecast Module B
- Forecast Module C
- Forecast Module D
- Forecast Module N
- Forecast Integrator
- Post Processor
- Forecast Product

Data Ingest

- "NOAA" Weather Data
- FSL Ensemble
- DOT Weather Data
- LL Video Data

"NOAA" Weather Data

FSL Ensemble

DOT Weather Data

LL Video Data

DOT Operations Data

Road Condition Modules - CRREL

Decision Support System Module CRREL

GIS Display

CRREL

Weather Parameter Output

Point & Time Specific Output

Data Interface to External Systems

Forecast Module A
Forecast Module B
Forecast Module C
Forecast Module D
Forecast Module N
Forecast Integrator
Post Processor
Forecast Product

Road Condition

Modules - CRREL

Decision Support
System Module CRREL

GIS Display

CRREL

Data Interface to External Systems
National Center for Atmospheric Research
Research Application Program

Road Weather Forecast System

NCAR/RAP
Road Weather Forecast System - NCAR

Multiple Input Data Sources

Weather Data Ingest Module

- Wx Forecast Module A
- Wx Forecast Module B
- Wx Forecast Module C
- Wx Forecast Module D
- Wx Forecast Module N

Forecast Integrator

Post Processor

Forecast Product

Point Forecasts
Sample Environmental Prediction Sites

All observational weather data are necessary to improve forecasts!

The system will be designed to utilize all data available including: DOT, NWS, DoD, air quality, and hydrology networks.

Environmental prediction parameters will be generated along the road.
The Road Weather Forecast System will generate point specific forecasts of environmental parameters along road corridors.

Example: Precipitation Type
MDSS
Single Point
Time Series
Forecast Systems Laboratory
Ensemble Forecasting

Models: WRF, MM5, RAMS
Initialization: AVN, Eta, RUC

9-Member Ensemble
To
Road Weather Forecast System

MM5 & Eta models (12 km grid)
Precipitation Type Algorithms

Rain?
Snow?
Ice?
Mixed?
Illustrates the sensitivity of salt concentration with time during a predicted weather event for multiple treatment options.
Two-Day Friction Coefficient History
*With and Without Treatment*
Prediction Point #3

**Friction Coefficient with No Maintenance Efforts**

**Friction Coefficient with Recommended Maintenance Efforts**

LOS 1

**Time Since Awareness (hrs)**

- Midnight Tuesday
- Midnight Wednesday
- Midnight Thursday
CRREL - 3-Dimensional Snow Drift Model

Model Input:
- DEM (10 m)
- Vegetation
- Met data

Model Output

Snow depth overlay
Game Plan

- Crew
- Trucks
- Material Stocks
  - ✓ Truck Routes
  - ✓ Standard
  - □ Custom
- ✓ Road Status
- □ Logistics Matrix

Sample: Route Specific Guidance
LL Video Image Edge Detection Processing