Evolution and Deployment of an Effective Maintenance Decision Support System

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National Rural ITS Conference 2010
Huntington, WV
August 2, 2010
Explosion in ‘Road Weather’

Surface Transportation Weather

- Clarus
- NAS Report
- AMS Policy Forum
- WIST Report
- PFS MDSS Effort Begins
- MDSS FP Effort Begins
- Nebraska 511
- COMET FHWA/NWS
- OFCM WIST II
- NITSA Version 4.0
- WsDOT rWeather
- STWDSR
- OFCM WIST I
- FORETELL Begins
- FHWA RWMP Established
- SAFE Deployment in ND & SD
- Aurora Established
- UND ATWIS En-Route Weather
- ITSA WIATF
- RWIS Weather Forecasting
- SHRP - RWIS

Completion of the National Interstate Highway System (~100 years)
What is MDSS?

A Maintenance Decision Support System is anything aiding the maintenance decision process:

• Prior Knowledge & Experience
• Snow and Ice Guidance Documents
• RWIS-ESS Observations
• Fellow operators/supervisors (communication)
• “That’s the way we’ve always done it”
• A computer system that integrates weather, road, and maintenance information to provide scientifically driven recommendations
MDSS is New...but Not Unproven

2000
Surface Transportation Weather Decision Support Requirements (FHWA)

2001
FHWA Functional Prototype (by NCAR)

2002
Assess DOT Needs, Readiness
Evaluate FHWA Functional Prototype

2003
Develop MDSS Software

2004
6-State Limited Deployment

2005
Refine MDSS Software
Validation Studies

2006
8-State Field Trials
10-State Field Trials

2007
Expanded Deployment

2008
12-State Field Trials
Independent B/C Analysis

2009
14-State Field Trials
Broad Deployment
Refinement, Management Tools

2010
Present Members: 15 State DOTs

- **2002**
  - IN, MN, ND, SD, IA
- **2004**
  - CO
- **2005**
  - KS, WY
- **2006**
  - CA, NH
- **2007**
  - NY, VA, NE
- **2008**
  - KY
- **2009**
  - ID, PA, WI
MDSS PFS Implementation Model

- Pooled Fund
- Study MDSS
- Progression
- Operation
- Implement
- Expand
- Enhance
- Innovation
- Envision
- Build
- Design
- Demonstration
- Test
- Refine
- Evaluate
- Evaluate

Progression:

1. Envision
2. Design
3. Build
4. Test
5. Refine
6. Evaluate
7. Enhance
8. Expand
9. Implement
10. Operation
Premise of a Fully Integrated MDSS

• Scientific approach to providing maintenance recommendations
• Integrate all possible weather data
  – Observations (RWIS, Radar, METAR, etc.)
  – Modeling (Weather, Pavement)
• Integrate maintenance data
  – Automated or manually provided from field
• Apply physical and chemical principles
MDSS Operating Principle

If you know...
• road characteristics
• current conditions
• predicted weather
• physics & chemistry of snow, ice, chemicals
• available resources (material, equipment, schedule)

MDSS can recommend...
• treatment type
• application rate
• optimal timing

...and predict
• future road conditions with or without treatments
Road Surface Modeling

MDSS considers past, current, and future conditions & actions.
Road Condition Prediction

Driving

03/11/2006 08:00 CST

Pavement Temp: 32.5 F
Percent Ice: 44%
L/I/I/F/S Depths: 0.019 / 0.000 / 0.000 / 0.15"
No Materials Present

Passing

03/11/2006 08:00 CST

Pavement Temp: 32.0 F
Percent Ice: 45%
L/I/I/F/S Depths: 0.020 / 0.000 / 0.000 / 0.17"
No Materials Present
Benefits Achieved by States Who Have Deployed MDSS

• Reduced salt use
• Decreased overtime
• Decreased fuel use
• Better communication across agencies’ political boundaries
• Consistent road conditions across agencies’ political boundaries
• Greater accountability in maintenance practices
• Ability to assess severity of winter in terms of required maintenance response
Predicted Cost Savings
(Western Transportation Institute)

- Same level of service with less cost
  - 23% material savings in New Hampshire study
- Achieve better level of service at same cost
  - 10-15% less “unacceptable” conditions in New Hampshire study
- 8:1 Benefit/Cost Ratio New Hampshire
- Similar studies performed in MN, CO
- Only salt costs considered
Realized Cost Savings

• InDOT Winter of 2008-2009
  – $9,978,536 in Salt Savings
  – $979,136 in Overtime Savings
  – 13.7% reduction in Fuel Use

• MnDOT Winter of 2009-2010
  – Salt Savings potential of $8,129,872.46
  – Salt Savings potential in Christmas 2009 Storm: $627,892.23

• SDDOT Winter 2008-2009
  – Case study of $60/lane-mile vs. $300/lane-mile
Data Management Tool Interface
Other Applications

- “Storm playback” of recent or saved storms at user-defined pace
  - Evaluation of maintenance operations
  - What information was available for decisions and when
  - Train new employees on winter maintenance concepts and use of MDSS
  - Predict effects of programmatic changes

- Support emergency and traffic management
Lessons Learned

• Winter maintenance is complex
• MDSS does not replace the decision maker
• MDSS requires & drives culture change
• Implementation process takes time
• Training is crucial to adoption & acceptance
• MDSS technology is still young and will continue to mature
Current Technical Directions

- Foster initial deployments
- Evaluate, validate predictive capabilities
- Refine physical models
- More effectively use mobile data collection
- Link to other DOT systems
  - Maintenance Management
  - Asset Management
  - Traveler Information
- More powerful management tools & reports
Benefits of Pooled Fund Study

- Jointly directed leading-edge R&D
- Convenient funding mechanism
- Low-risk opportunity to deploy
- Learning
  - State to State
  - Vendor to State
  - State to Vendor
- Intellectual property: open but not public domain

New States Are Welcome

- Nationally prominent forum for advancing MDSS and related technologies
Questions?

Thanks to:

Ben Hershey, John Mewes,
Bob Hart, Leon Osborne
Meridian Environmental Technology

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