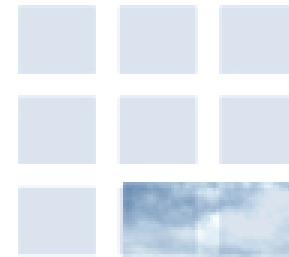




NCAR



# Decision Support Systems: Meeting Consumer Expectations

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# Outline


- The process of evaluating the client's needs
- Defining a Decision Support System (DSS)
- Assessing the client's culture
- Strategies for optimizing end-user buy-in
- Case example - MDSS

NCAR

### Fighting snow and ice with technology

Knowing when to treat the roads before a snowstorm used to be partly guesswork — sometimes a radio forecast or even an achy joint. But this winter the Colorado Department of Transportation is using a new system that rivals battlefield technology. The key to the Maintenance Decision Support System is a computer program that sorts through weather forecasts, radar and temperature readings and combines that information with real-time observations from snowplow drivers and maintenance shops. Ultimately, that leads to one plan of attack.

#### Key pieces of system

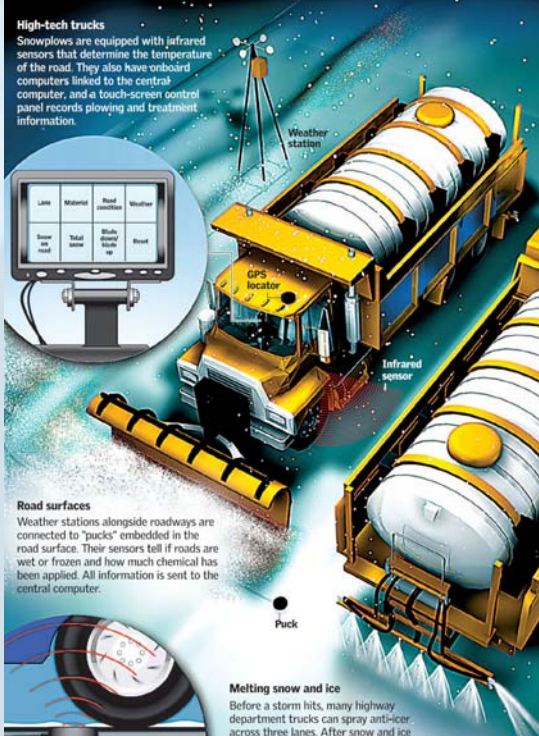


**Weather information**

- **Weather stations:** Hundreds of sites across the state send readings for temperature, wind, dew point, hourly precipitation and snowfall to a central computer. That and satellite information is combined with 15 forecasts. Once real-time information from snowplow drivers is added, the most accurate weather prediction is selected.
- **Selected roads:** The MDSS was successfully tested in the Greeley area last year. It has expanded this year, but because of limited equipment, it is designated for highways that often see difficult weather conditions.

#### High-tech trucks

Snowplows are equipped with infrared sensors that determine the temperature of the road. They also have onboard computers linked to the central computer, and a touch-screen control panel records plowing and treatment information.



**Road surfaces**

Weather stations alongside roadways are connected to "pucks" embedded in the road surface. Their sensors tell if roads are wet or frozen and how much chemical has been applied. All information is sent to the central computer.

**Melting snow and ice**

Before a storm hits, many highway department trucks can spray anti-icer across three lanes. After snow and ice have built up, de-icer is directed over one lane in a more powerful stream to the pavement below. Snowplows carry about 1,600 gallons of anti-icer/de-icer.

**Puck**

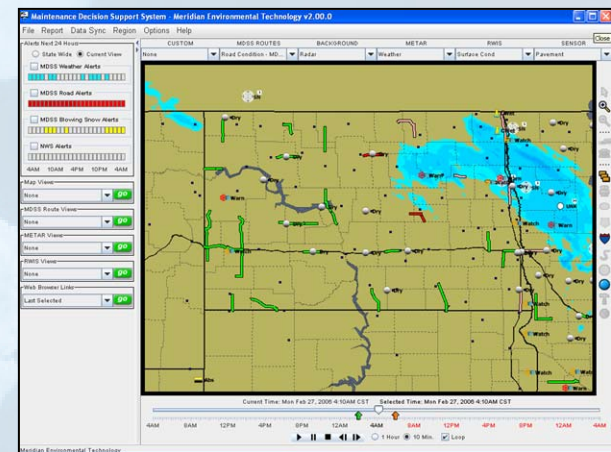
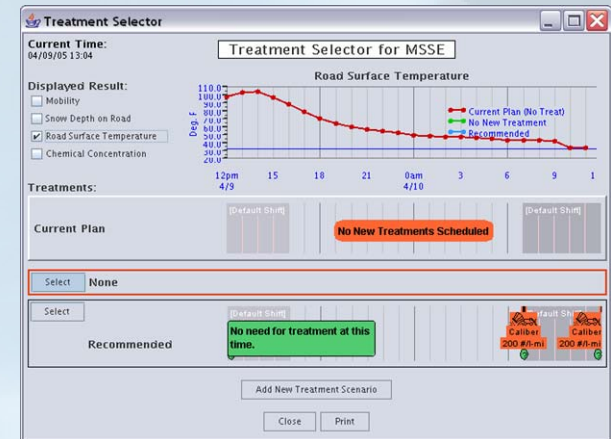
Puck is embedded in the roadway and flush with the surface

Source: Roy Smith and Alan Martinez, Colorado Department of Transportation | Jon Moreno, Joe Watt and Jeff Goertzen | The Denver Post

# Adopting an MDSS




- The MDSS is a sophisticated technology that utilizes imperfect input data and rules of practice
- Rapid adoption by end users is not likely for multiple reasons
- The adoption process can be improved by ensuring that the end users understand the system capabilities and limitations and by taking steps to improve user buy-in



Sample MDSS screen images from the FHWA prototype (top) and Pooled Fund (lower).

# Assessing the Client's Needs



- It is imperative that a relationship of trust be developed with the end-user (customer)
  - No B.S. sales pitches 
- Patiently listening to their needs and issues is a critical first step
  - Learn about their decision processes
  - Understand their environment, constraints, etc.
- You need to understand their world in their terms

# Decision Support Systems



What is a decision support system?

- a) An automated tool that makes decisions?
- b) A semi-automated tool?
- c) A handbook of recommended practices?
- d) Local newspaper or news program?
- e) Student assistant?

**Answer: All the above!**

# Decision Support Systems



- Need to assess what MDSS products would be most useful:
  - Site specific weather forecasts?
  - Site specific road condition forecasts?
  - Integrated display of general weather conditions?
  - Treatment recommendations?
- It may be that only certain MDSS capabilities are required or supportable.

# Assessing the Culture



Before one can consider implementing an MDSS, some important questions need to be asked to assess the customer's culture.



MDSS end-user meeting – Ames, IA

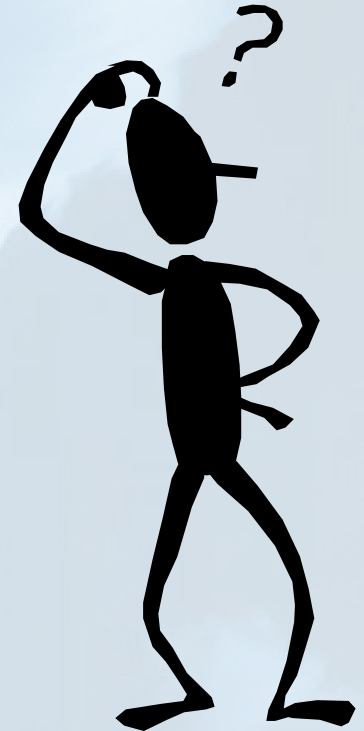
# Assessing the Culture



## First Question:

- 1) What operational issues are you trying to address with an MDSS?
  - improved efficiencies?
  - Improved safety?
  - more consistent operation?
  - improved training?

You need to understand the users' decision process. Probing questions must be asked several different ways before a potential answer or solution may emerge.



# Assessing the Culture



## 2) What is the culture of the client's organization?

- Would a DSS be seen as threatening?
- Does automation pose problems?
- Are general support tools viewed positively?



# Assessing the Culture



## 3) What actual tasks and/or decisions could be supported?

- Routine or mundane tasks (e.g., road data analysis)
- High-level analytical tasks (e.g., information assimilation)
- Critical decisions (e.g., impacting lives or costs such as identifying treatment plans)

# Assessing the Culture



## 4) What job categories would benefit most?

- Operators
- Supervisors
- Middle managers
- Senior managers
- Executives

Knowing the job category(s) that will utilize the decision support system will allow intelligent judgments to be made about the design and human factors issues.

# Assessing the Culture



## 5) What technical capabilities exist?

- Is there an in-house framework to support the new technology?
- Network system (external & internal)
- Desktop computers for end-users
- Remote field communications (PDAs)
- Database of pertinent operations data



TRS-80 Computer

# Assessing the Culture



## 6) What are the potential benefits?

- Safety
- Property Protection
- Productivity
- Risk Reduction



# Assessing the Culture



## 7) Who will champion the technology?

- Management vs. staff
- Technology push (by management) or pull (from staff)?



# Assessing the Culture



## 8) What are the customers expectations?

This is very important!

It is critical that users expectations are at the appropriate level when new technologies (e.g., MDSS) are introduced. It is always better to error on the side of caution and let the users be creative on how they utilize new capabilities.

# Decision Support Systems



- There are no off-the-shelf *plug and play* DSSs that can fully address the needs of all end-users. There are no “one-size-fits-all” solutions!
- A “bottoms-up” rather than a “tops-down” approach should be used for DSS system development and tailoring.
- Stakeholders need to determine the level of sophistication that is required for their specific DSS application.

# MDSS Challenges



Weather diagnosis and prediction is an imperfect science

- Each DOT has difference needs for an MDSS
- There is a lot of diversity between DOTs
  - Operational procedures
  - Rules of practice
  - Equipment
  - Legal constraints
  - Funding constraints
  - Levels of experience

## Realization

DOTs must understand that it may take several years to optimize and configure a DSS tailored for their operations. Once established, complex systems such as an MDSS will require significant maintenance and support to ensure all the information in the system is current.