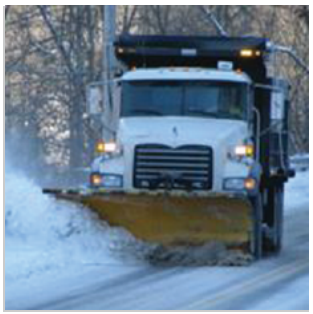
A Clear Roads Research Project

Understanding the True Cost of Snow and Ice Control

Webinar

December 18, 2013




Clear Roads' Goals

This research project is an effort of Clear Roads

(A multi-state pooled research fund)

Clear Roads initiated this study to identify ways to better manage winter maintenance through:

- Having more data driven management
  - Understanding the link between level of effort and results (level of service achieved.)
- Improving efficiency and effectiveness of winter maintenance
  - Measuring efficiencies and make comparisons to identify improvements
- Better understanding and communicating costs of maintenance
  - Providing critical information to policy makers to support decisions

Data Analysis

To achieve these goals the research team evaluated available data from several states to developed a strategy for identifying the cost of work performed during a storm event.

Strategy: Link the work performed to the level of service achieved during a storm event.

- Provide data on which to evaluate cost of achieving LOS
- Identify specific efficiencies by comparing costs by work performed
- More easily communicate true cost of winter maintenance.

Data Gaps

- During the analysis, consistent data gaps were identified across states:

    1. There is no link between **level of service** and **lane-mile cost**
    2. There is no link between assumptions regarding the **number and intensity** of storms to **cost**

- Most state DOTs use separate financial and maintenance management systems that track costs and work performed differently, resulting in these data gaps.

- The research team took the opportunity to evaluate the data collection efforts of state DOTs and recommend improvements.

Research: Data Received

Many DOT's provided data for analysis, but Maine had the most comprehensive data set most easily analyzed.

Maintenance Areas:
- Crew Name
- Lane-Miles by LOS
- Roadway Functional Class
- Urban or Rural

Storm Data:
- Unique Storm ID
- Crew Maintenance Area
- Storm Type
- Precipitation Depth
- Crew Actions & Dates

Material:
- Storm ID and Crew
- Material Name
- Quantities Used
- No Unit Costs
- Pass-Lane Miles

Labor:
- Storm ID and Crew
- Labor Category
- Hours
- Hourly Rate

Equipment:
- Storm ID and Crew
- Equipment Type
- Quantities
- Hours
- Hourly Rate
- Days
- Daily Rate

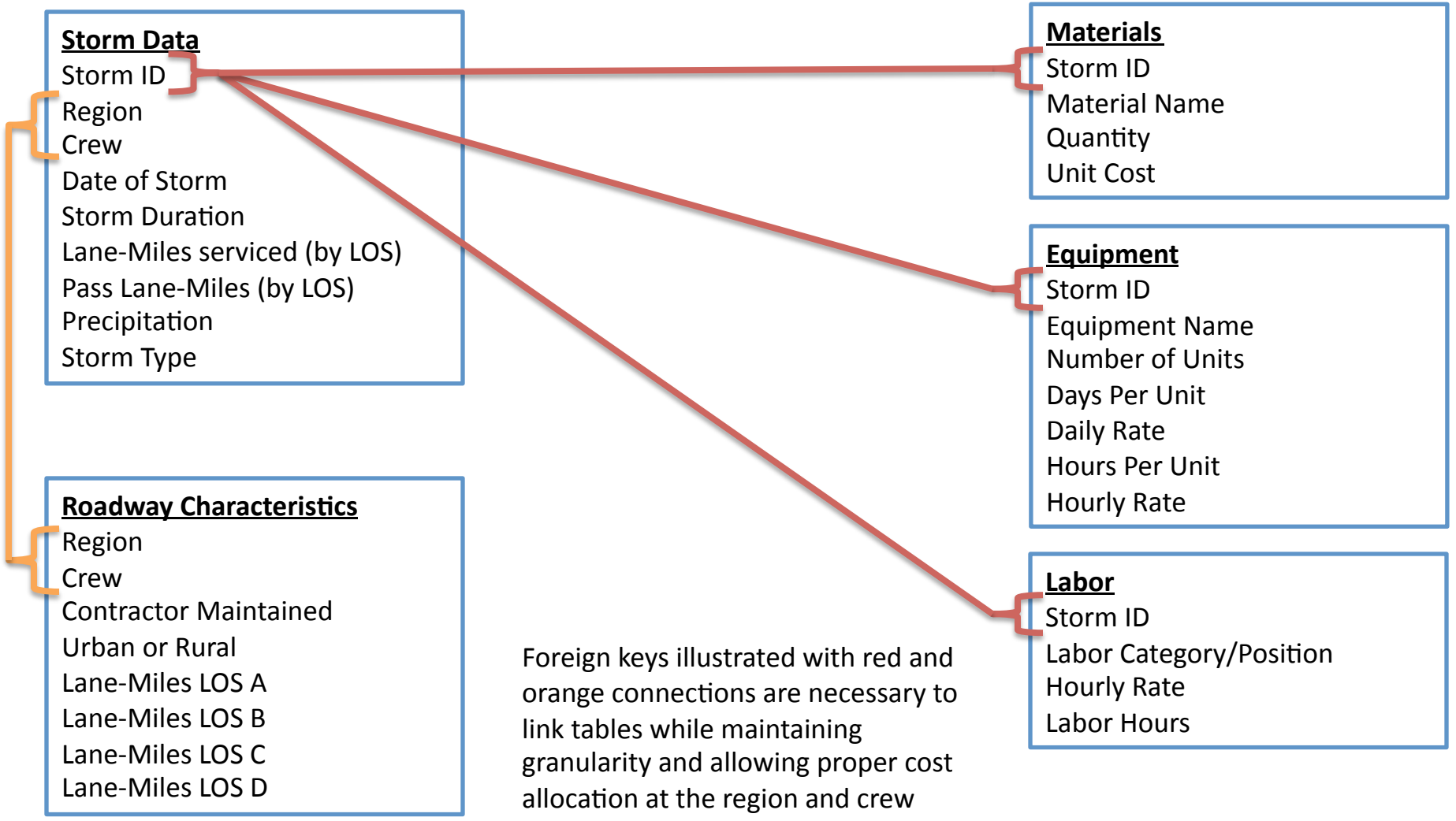
Lessons Learned: What Data to Collect?

- Allocate Costs Appropriately:
  - Use a unique storm identification number (ID) for each storm
  - Assign a unique crew and/or region IDs
  - Allocate costs to unique storm, crew and/or region ID
  - Document the number of lane-miles in the crew area by LOS
  - Record unit costs and quantities for labor, equipment, and materials
  - Record the pass-lane-miles accomplished during storm events by LOS (Data Limitation 1)
  - Record storm characteristics uniformly (Data Limitation 2)
- Data Integrity and Usability
  - Use a relational database
  - Reduce the use of unstructured fields
  - Don’t concatenate fields

Lessons Learned: What Data to Collect? (Data Checklist)

Variable	Unit	Check
Storm Characteristics		
Storm ID Number	Name	☐
Date of Storm	mm/dd/yyyy	☐
Lane-miles Serviced	Lane-miles	☐
Pass Lane-miles Accomplished	Lane-miles	☐
Storm Duration	Hours	☐
Precipitation	Inches	☐
Storm Type	Type	☐
Roadway Characteristics		
Private Contactor	Yes/No	☐
District Identification Number	Number/Code	☐
Crew Identification Number	Number/Code	☐
Urban vs. Rural	Urban/Rural	☐
Lane Miles (in each crew area)	Lane-miles	☐
Materials		
Material Name	Name	☐
Quantity	Unit	☐
Unit Cost	Dollars	☐
Equipment		
Equipment Name	Name	☐
Number of Units	Count	☐
Days per Unit	Days	☐
Hours per Day	Hours	☐
Daily Rate	Dollars	☐
Hourly Rate	Dollars	☐
Labor		
Labor Category/Position	Name	☐
Hourly Rate	Dollars	☐
Positions in Subarea	Count	☐
Number of Days on Job	Days	☐
Hours Worked per Day	Hours	☐

Lessons Learned: Storing Data for Analysis (Relational Database)



Foreign keys illustrated with red and orange connections are necessary to link tables while maintaining granularity and allowing proper cost allocation at the region and crew level.

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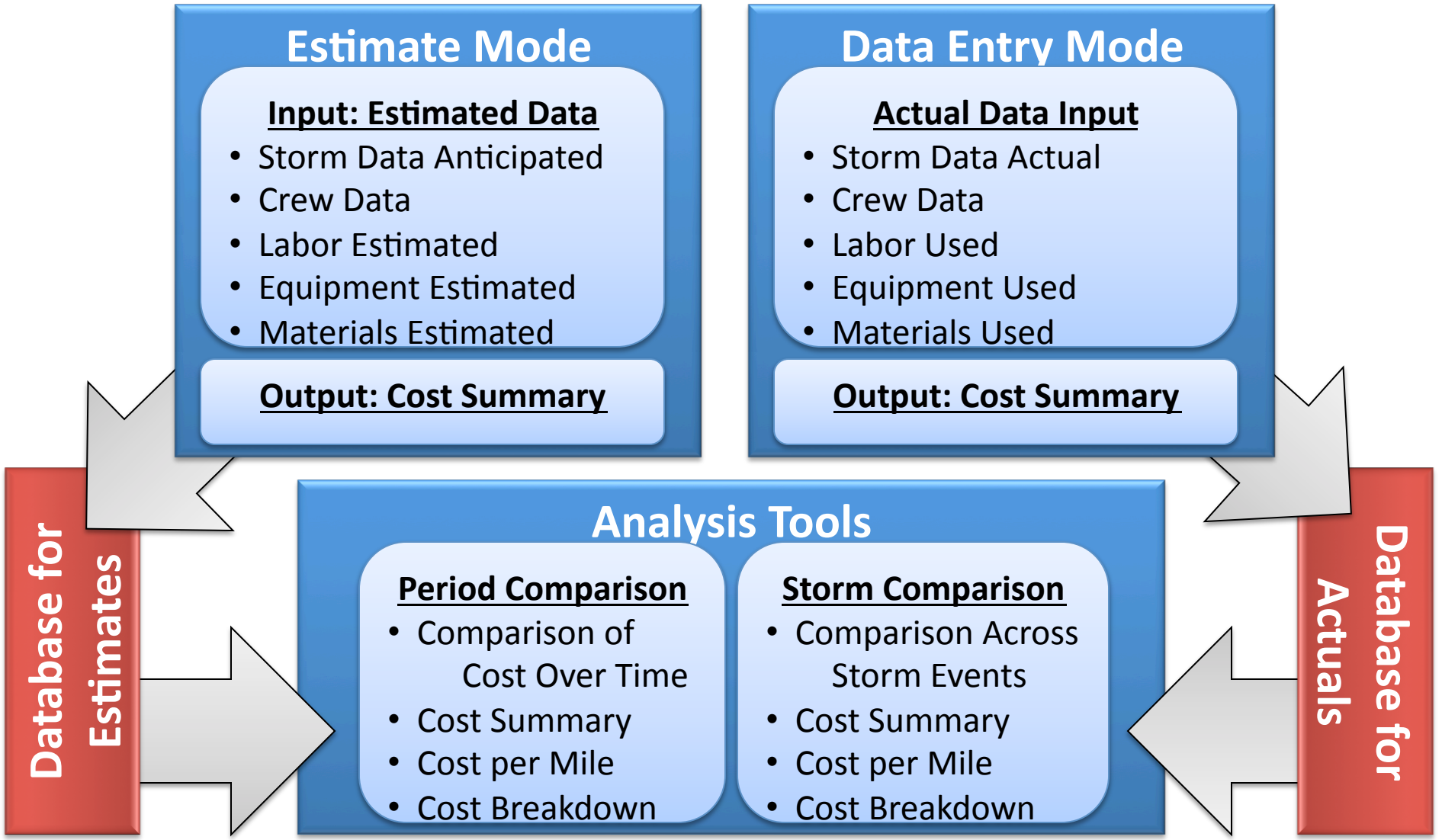
Tool Development: Approach

- Given existing limitations in historical data, the team developed a tool that would achieve the original goals as new data is collected.
- The Clear Roads Team developed the following objectives for the tool:
  - Perform what-if scenario testing on unit costs
  - Communicate cost drivers to policy-makers and the public
  - Allow managers to better understand and manage costs
  - Compare winter maintenance costs across storms, regions, and states
  - Facilitate evaluation of the cost effectiveness of winter maintenance policies
  - Compare contracted vs. state maintenance
  - Compare winter maintenance costs over time
  - Directly link assumptions regarding the number and intensity of storms to cost
  - Directly link levels of service to lane-mile cost

Tool: Feature Overview

- The True Cost Tool:
  - Allows user to input data
    - Collects the data needed for analysis
    - Stores the data to facilitate data analysis
    - Supports estimation of storm cost
  - Incorporates additional tools to analyze the data entered
    - Average cost per lane-mile
    - Period comparison
    - Storm event comparison

Tool: Overview



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Tool: Estimate Mode

Estimate Mode

Input: Estimated Data

- Storm Data Anticipated
- Crew Data
- Labor Estimated
- Equipment Estimated
- Materials Estimated

Output: Cost Summary

Data Entry Mode

Actual Data Input

- Storm Data Actual
- Crew Data
- Labor Used
- Equipment Used
- Materials Used

Output: Cost Summary

Database for Estimates

Objectives	True Cost Tool
Perform what-if scenario testing on unit costs	✓
Communicate cost drivers to policy-makers and the public	✓
Allow managers to better understand and manage costs	✓

Tool: Data Entry Mode

Data Entry Mode

Actual Data Input

- Storm Data Actual
- Crew Data
- Labor Used
- Equipment Used
- Materials Used

Output: Cost Summary

Database for Actuals

Objectives	True Cost Tool
Communicate cost drivers to policy-makers and the public	✓
Allow managers to better understand and manage costs	✓
Collect and store needed data for future analysis	+

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Tool: Storm Comparison Tool

Objectives	True Cost Tool
Compare winter maintenance costs across storms, districts or regions, and states	✓
Facilitate evaluation of cost effectiveness of winter maintenance policies	~
Perform what-if scenario testing on unit costs	✓
Communicate cost drivers to policy-makers and the public	✓
Allow managers to better understand and manage costs	✓

Database for Estimates

Analysis Tools

Storm Comparison

- Comparison Across Storm Events
- Cost Summary
- Cost per Mile
- Cost Breakdown

Database for Actuals

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Tool: Storm Comparison Tool

Objectives	True Cost Tool
Compare contracted vs. state maintenance	✓
Compare winter maintenance costs across time	✓
Perform what-if scenario testing on unit costs	✓
Communicate cost drivers to policy-makers and the public	✓
Allow managers to better understand and manage costs	✓

Database for Estimates

Analysis Tools

Period Comparison

- Comparison of Cost Over Time
- Cost Summary
- Cost per Mile
- Cost Breakdown

Database for Actuals

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Objectives - Results

- ✓ Perform what-if scenario testing on unit costs
- ✓ Communicate cost drivers to policy-makers and the public
- ✓ Allow managers to better understand and manage costs
- ✓ Compare winter maintenance costs across storms, districts or regions, and states
- ~ Facilitate evaluation of cost effectiveness of winter maintenance policies
- ✓ Compare contracted vs. state maintenance
- ✓ Compare winter maintenance costs across time
- ■ Directly link assumptions regarding the number and intensity of storms to cost
- ■ Directly link levels of service to lane-mile cost

✓ Achieved ~ Partially Met ■ Requires More Data

True Cost Tool: Demonstration

- Demonstration of the True Cost Tool
  - Data Inputs
  - Summary Outputs
  - Saving Data
  - Analysis Tools
    - Storm Comparison
    - Period Comparison

Next Steps:

- ✓ Develop Estimation Tool
- ✓ Develop Data Collection Tool
- Develop Data Collection Methodology
  - Uniform data collection to ensure data integrity
- Develop Web-Based Tool
  - Easy access for data entry and data sharing among localities
- Support Data Collection by States
- Consolidate Collected Data and Perform Analysis
- Compare Aggregated Data
- Draw Conclusions and Present Results

Thank You

Questions?