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# Discussion

## CHAPTER 4

**D**uring the course of our review of snow and ice control, recurring themes emerged. We now present a broad analysis of the observations and information gained through our statewide surveys, focus groups, and site visits to a sample of Minnesota local governments. We address the following issues in this chapter:

- **What are the current trends in snow and ice control in Minnesota?**
- **What were the constraints of our snowplowing review?**
- **What information or research on snow and ice control do local governments need?**

Although we consulted extensive literature for our review, our discussion of trends relies on Minnesota experiences.

### TRENDS AND OBSERVATIONS

Analysis of our survey results, site visits, and other data revealed some common trends and observations about snow and ice control. The trends generally follow the objectives of increasing the level of service in a jurisdiction and broadening the base of knowledge on snow and ice control practices.

- **Public expectations substantially affect the levels of service for snow and ice**

**operations within a particular jurisdiction.**

We found that the level of service expected by the public or its elected officials affects staffing, equipment, and material needs for a public works department. For example, if a jurisdiction demands bare pavement, the department needs the support (e.g., staffing, equipment, and materials) to achieve that demand. On the other hand, if a jurisdiction expects main roads to be substantially bare but requires secondary roads to be cleared only to the point that safe travel is maintained, different resources are required. Practices resulting in bare pavements can be more expensive and are not universally needed. What is considered a best practice, therefore, differs among jurisdictions according to the particular level of service demanded.

- **By starting their snowplowing efforts earlier during a snow event, departments focus on preventing the snow and ice from bonding to the pavement.**

Many departments with whom we spoke are starting their snowplowing routes earlier than in the past to plow snow off the roads before heavy traffic packs it down. Not only do departments begin their snowplowing efforts earlier in a snow event, but they call in their plowing crews earlier in the morning. This preventive tactic improves the level of service and reduces the

*Local road departments would benefit from additional winter maintenance research that focuses on experiences at the local government level.*

amount of time and labor needed to plow snow after it has hardened.

- **A supportive governing body may lead to increased innovation and effectiveness in a department's snow and ice control practices.**

A number of the sites we visited attribute the effectiveness of their snow and ice control to supportive governing bodies. Departments that are able to increase their efficiency and effectiveness often have elected boards and councils which encourage and reward safety, innovation, and change. Many public works officials noted the importance of gaining the support of a governing body when proposing a new practice. They indicated that the ability to track and report the effectiveness of a new practice, through performance records, cost savings, or public comments, can increase the confidence and support imparted by the board or council.

- **Some local departments use higher ratios of salt in their sand and salt mixes.**

Some departments told us that increasing the ratio of salt to sand in their mixes produces a faster reaction time which leads to safer roads and a higher

level of service. Most departments using a higher salt concentration do not believe that their annual salt consumption has increased markedly, if at all. In fact, departments using higher ratios of salt told us that they have cut the number of plow passes necessary during a storm, sometimes in half. They believe that the concentrated salt or mix works more effectively, requiring less total tonnage of the materials overall. Some also prewet their salt or mix for faster melting action and better undercutting of ice than dry salt.

***Some use higher ratios of salt to reduce the number of plow passes and lower salt use overall.***

- **Cul-de-sacs present a snowplowing challenge for jurisdictions that have them in their road systems.**

Departments consistently noted in our surveys, focus groups, and interviews the problems that they encounter plowing cul-de-sacs. First, the size and configuration of some cul-de-sacs prevent a regular snowplow truck from plowing them effectively, and therefore, require different equipment. Second, operators face a dilemma because, while they do not want to fill homeowners' driveways with snow as they make their pass, there is limited space to put the snow.

Because cities' road systems typically have many more cul-de-sacs than other local governments, this plowing challenge is largely confined to cities. Most departments try several snowplowing methods before settling on one particular practice. Because of the diversity among cul-de-sacs in width, length, and center storage space, the transferability of plowing techniques from one jurisdiction to another can prove difficult.

- **Some practices that appear to be effective or innovative at first glance may not be so under greater scrutiny.**

During the course of this review we encountered some ideas that appeared innovative but that actually proved unsuccessful. In some cases, an idea that seems to work well in other states or other countries simply has not worked well in Minnesota tests. For example, we learned about a product that mixes a deicer (calcium chloride) in pellet form into asphalt for the top layer of a road. When maintenance workers lay the asphalt, they are essentially building the deicer into the road surface. The friction of normal traffic crushes the deicer pellets, forming a film on the paved surface to prevent snow and ice from adhering. Although conceptually attractive, the product did not prove cost effective when Mn/DOT tested it here.

- **Local jurisdictions are concerned about liability for accidents on their roads.**

In addition to concern about the possibility of road accidents, many local governments are concerned with the prospect of liability arising from our snow and ice control best practices review. Some local officials fear that the practices highlighted in this review will become performance standards admissible in a court of law. We believe that the best practices included in this review are examples of effective approaches to snow and ice control that some local jurisdictions have found to work well. Each local government must individually evaluate the potential benefit and transferability of a particular practice to its own jurisdiction. Because every jurisdiction is unique, no one best practice necessarily fits all jurisdictions.

## CONSTRAINTS AND LIMITATIONS

This snow and ice control best practices review faced some constraints which influenced both its scope and direction. Principal constraints included a lack of comparative performance measures, inadequate record keeping, unquantifiable organizational differences among communities, and a lack of independent evaluation of local practices. This section briefly addresses each constraint.

- **Comparative "baselines" of snowplowing performance measures can be inadequate when levels of service vary among jurisdictions and when winter storms differ from area to area.**

As mentioned earlier, different jurisdictions require different levels of snow and ice control service. Traffic levels, types of roads, and public expectations vary around the state, as do service levels. Consequently, we found it difficult to develop any baseline of performance against which departments could readily compare themselves. The data we collected did not show us what level of service is appropriate for particular jurisdictions.

Similarly, because winter storms vary considerably, we found it difficult to develop a general set of measures to use for comparing snowplowing performance across jurisdictions. Because the amount, type, and time of precipitation differs from one ju-

risdiction to the next for the same snow or ice storm, responses will differ. A storm might arrive in western jurisdictions with light drizzle two hours before hitting eastern jurisdictions, where it builds in intensity and produces several inches of snow. Even within a jurisdiction, especially the larger ones, weather conditions vary; what happens in the northern section of a county, for example, may be different from what happens in the southern.

Further, no two winter storms are identical. Storms produce different types and amounts of precipitation, requiring somewhat different responses. The most effective type of material, method of application, plowing technique, and time of call out differs for each particular storm based upon that specific storm's characteristics. Responses also vary according to whether roads are paved or gravel. We believe that one set of performance standards is inadequate to compare different jurisdictions with unique conditions and distinct responses to storms.

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***Variations in snow storms and road conditions make comparisons of multiple departments difficult.***

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Recognizing these constraints, however, does not mean local governments should avoid measuring their snow and ice control performance. Rather, it points to the need for departments to set their own standards of performance. Departments should make careful measurements over several snow seasons, particularly when comparing multiple jurisdictions. Examples of measures that departments use today include measuring for each snowstorm, and for different street and weather conditions, the amount of staff hours spent for plowing and cleanup activities, the equipment and fuel used, the amount of sand, salt, or other materials used, and the time between the call out and when plowing begins. Appendix F describes other measures of performance.

- **Record keeping for snow and ice control varies across jurisdictions. Some**

**departments have no systematic method of snow and ice control record keeping; others keep complete and precise records.**

The scope of recording costs, personnel, materials, equipment, miles, and time, varies greatly among jurisdictions. Some departments do not have separate budgets for snow and ice control, but instead combine winter maintenance activities with other road maintenance throughout the year, using a single annual budget. Departments that do record snow and ice control expenditures do not necessarily separate the costs of the various kinds of snow and ice control activities, such as plowing snow, applying materials, or repairing equipment. In addition, some departments include vehicle depreciation or shared equipment costs in their operating expenses while others do not.

Likewise, some departments rigorously record information on the outputs or outcomes of their snow and ice control services, such as time required to adequately plow routes, amount of materials used per route or per storm, responses to complaints, and repairs of property damage. Other departments might record little more than the annual amounts of sand or salt they use. The lack of uniform data limits the possibility of measuring and comparing performance, cost effectiveness, and efficiency among departments.

- **Organizational differences among jurisdictions are difficult to quantify in a reliable manner.**

The scope of our review does not include organizational differences among jurisdictions that might influence snow and ice control practices. We found that intangible variables, such as the level of support from elected officials, the degree of decentralized decision-making, and the organizational culture (flexibility, creativity, and willingness to change) likely affect the success of snow and ice control in a jurisdiction. Yet we found it difficult to incorporate these factors into this best practices review due to their subjective nature and the impracticability of measuring them.

- **We did not independently verify the costs or effectiveness of the practices in this review.**

Although the local departments we interviewed indicated that they either improved their service or saved time, money, difficulties, or labor by using a given practice, we have not independently measured the effect of the practices in the jurisdictions. We asked the departments whether the practice produced any type of savings for them, and whether they evaluated its effectiveness. Most often, department officials believed the practices generated savings but did not explicitly evaluate them. We relied on departments' experience with, and perceptions of, the practices and their effectiveness for this review.

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***We relied on local departments' assessments of the practices' effectiveness.***

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- **Departments may readily duplicate some of the practices identified in this review but may find others less easy to transfer to their own jurisdiction.**

Our list of effective practices includes examples that can be implemented in other jurisdictions with similar characteristics. However, some practices that one particular department found effective may not be readily transferable to others, due to the specific nature of the practice (such as meeting a public demand, responding to a geographic constraint, or working within ordinances peculiar to a particular jurisdiction). Because jurisdictions are unique, each department must evaluate the potential for cost savings and ease of transferability for itself.

## **ADDITIONAL RESEARCH ORIENTED TO LOCAL GOVERNMENTS**

Effective snow and ice control practices and equipment continue to evolve. While some practices have been around a long time, others have been

gaining prominence more recently. For example, local departments are gradually increasing their focus on preventing snow and ice from bonding to the road, even as they still attend to the traditional business of plowing and scraping roads. With the added emphasis on prevention comes many questions about the best preventive strategies, and the circumstances where they work best. In addition, insufficient research focuses on local road systems and their needs.

- **Local road departments would benefit from additional winter maintenance research that focuses on experiences at the local government level.**

Local practitioners are interested in objective information that will allow them to make decisions about the cost effectiveness and practical applications of winter maintenance practices and equipment in their own jurisdictions. For any given practice with local applications, they want to know: how is it done, when is it effective, how much does it cost, what are its drawbacks, what is its best timing, and what road temperatures or conditions, traffic levels, and weather conditions make it most effective.

Some of the areas which warrant additional research are:

- Prewetting salt and sand, both as an anti-icing measure and for deicing,
- Using only liquids, such as salt brine, for anti-icing,
- Selecting the proper gradation of salt and sand for various uses,
- Recycling road sand sweepings for reuse,
- Using prototype equipment such as zero-velocity salt/sand spreaders and salt brine mixing systems,
- Using anti-corrosive compounds to lengthen the life span of equipment,
- Using various weather prediction systems,
- Storing materials such as salt, sand, and salt brines, and

- Determining the localized impacts of salt or other chemicals on the environment.

In addition, an economic analysis with uniform cost accounting of the various components of snow and ice control would allow local governments to compare themselves with others similar to them. Much of the current data collected on costs do not allow comparisons because local governments do not necessarily include the same items, such as overhead expenses, when they report costs.

Although many Minnesota jurisdictions are using effective snow and ice control practices, local governments often want additional comprehensive information. In addition, many local public works departments develop low-cost, innovative equipment in their shops to aid their work, but the innovations do not reach other jurisdictions. Constraints of cost, geography, and time all limit communication among jurisdictions. Yet departments responding to our survey indicated that they want and need information on current snow and ice control practices used throughout the state.

- **Local governments would benefit from improved access to the information and research findings of Mn/DOT and others.**

Jurisdictions we visited or surveyed conveyed an interest in the snow and ice control research conducted by Mn/DOT.

Many local governments view Mn/DOT's research as innovative and want ongoing updates on its findings, especially on research that can be generalized to the needs of local road systems.

Some efforts at providing information to local governments have already proven helpful. For instance, the Technology Transfer (T<sup>2</sup>) Program at the University of Minnesota's Center for Transportation Studies and the Minnesota Local Road Re-

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***Local departments told us that they want additional information on current snow and ice control practices.***

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search Board (LRRB) each have as part of their mission the communication of transportation research results to local governments. The T<sup>2</sup> program collaborated with Mn/DOT and the Federal Highway Administration in developing a "circuit rider van." The van's purpose is to travel around the state with information about the latest technologies and information on road construction and maintenance. Despite these efforts, many local governments with whom we spoke want more winter maintenance information, including the results of Mn/DOT research. At the local level, the desire to increase cost effectiveness and levels of service has led to a heightened interest in Mn/DOT's research results. A comprehensive system of disseminating information would allow local departments to keep abreast of gains in effectiveness and efficiency from new practices.

- **Local service providers want ongoing sharing of snow and ice control information among themselves.**

Opportunities for sharing transportation information already exist. Besides the LRRB and T<sup>2</sup> program, the Minnesota Street Superintendents Association meets monthly to share information among its members. Various organizations, such as the Minnesota Chapter of the Public Works Association, the City Engineers Association of Minnesota, and the Minnesota Association of County Engineers, conduct seminars and hold conferences on a variety of transportation topics including winter maintenance. Yet, according to our survey, not all departments have as much current, comprehensive information on effective snow and ice control practices as they would like.

Sharing winter maintenance information encourages local governments to continually seek and adopt approaches that will enhance the cost effectiveness and efficiency of their service delivery. This best practices review is one tool to facilitate the ongoing sharing of snow and ice control information across Minnesota jurisdictions. But as technology continues to change and improve, and as additional field applications of innovations are tested, local governments will need ongoing

sources of both comprehensive research and information sharing.