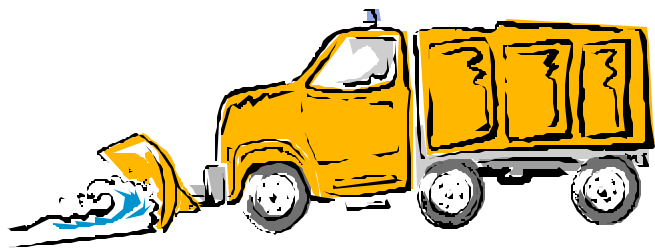


**SNOW AND ICE REMOVAL AND
CONTROL:
A REGIONAL BENCHMARKING
INITIATIVE**



**Prepared by:
The Capitol Region Council of Governments
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- INTRODUCTION -

Executive Summary

At the request of one of its member towns, the Capitol Region Council of Governments (CRCOG) agreed to initiate a regional benchmarking program to give local officials a framework for evaluating competing approaches to the provision of “bread and butter” municipal services. A subcommittee of town managers subsequently targeted several common Highway Department functions for the resulting study, and **snow and ice removal and control** was selected as the pilot topic for consideration.

The results of said study are published herein as a compendium of raw data and relevant analyses that: (1) characterizes the region’s response to a given storm event; (2) quantifies the resources allocated by each community (e.g., staffing, materials, equipment, etc.); (3) identifies the operational policies that govern individual (and often divergent) responses; (4) highlights less traditional strategies for enhancing removal and control activities that may warrant further consideration; and (5) prescribes a series of “next steps” that may help to identify best practices and facilitate their adoption more universally across the region.

Methodology

All forty-one members of CRCOG’s Purchasing Council were invited to participate in a snow and ice removal and control exercise this past winter. In total, some twenty-two communities completed questionnaires (See Appendix A--Parts I and II) reflecting their projected removal and control responses to a **hypothetical** snow event, created to ensure an apples-to-apples comparison of any and all resulting data. It was agreed that data collected from an **actual** storm event could be tainted by differences in town record-keeping methods as well as by naturally-occurring storm variations (e.g., temperature, total accumulation, precipitation form, time of onset and cessation of snowfall, etc.) across communities.

The snow event used for the exercise was characterized as follows:

“The storm commenced on a “normal” Tuesday at 1:00 p.m. Snow started at 30° and all precipitation was moderate snowfall. Total accumulation was 7”; the duration of the storm was 12 hours (ending at 1:00 a.m.), with a temperature of 28°. No unusual events occurred before, during or after the storm.”

Respondents were asked to: specify the staffing, equipment and material resources they would make use of for the event in question; note any and all associated costs; provide basic information about the scope of their operations; and highlight the procedural guidelines that direct their Department's snow response, either as a result of a formally adopted snow control policy, or based on informal performance standards (i.e., % of main roads open at all times, extent of black road/bare pavement policies—meaning clear of snow and ice, etc.).

Following the initial data collection session, CRCOG staff clarified any obvious “outlying” responses via phone and performed simple data conversions to facilitate comparisons across communities.

Study Limitations/Additional Considerations

The exercise described above was conceived as a vehicle for collecting the most fundamental data elements (inputs and outputs) in order to allow for basic inter-town comparisons. Accordingly, qualitative analyses designed to measure the effectiveness of each town's operations (in terms of road passability, general citizen satisfaction levels, etc.), fall outside the scope of this undertaking. Follow-up analyses, however, are planned, and may entail: citizen survey work, physical road inspections during actual storm events, and/or a review of police records to determine vehicle accident and property damage rates.

Moreover, given the hypothetical nature of the storm event in question, it must be realized that much of the information provided by the participants represents best “guesstimates” (in terms of required materials, staffing, and equipment), and not actual expenditure data.

Finally, it is important to emphasize that the purpose of this study was not to identify “less than optimal” snow plow operations, but rather to highlight those “best practices” that can be adopted by other departments in an effort to raise the baseline for performance and productivity across the region and beyond.

-STUDY RESULTS-

Characterizing the Region's Response

Given the lack of national, state and regional standards promulgated to address snow and ice removal and control activities, it is not surprising that CRCOG's study uncovered a relatively broad spectrum of policies and procedures that govern individual department responses and an equally diverse set of performance indicators. In fact, the only clear-cut patterns that did emerge can be quickly summarized as follows:

Materials

- ?? The vast majority (17 of 22) of the participating communities rely *solely* on road salt and sand to aid in clearing their roadways.

Equipment

- ?? Most pieces of snow clearing equipment in use are owned by the towns directly; if rental units must be secured, they typically represent a very small supplement to municipal forces and are always rented with an operator.
- ?? The 6-wheel combination plow/sander is by far the most popular vehicle employed by snow crews.

Labor

- ?? Only three of the communities make use of additional riders on various vehicles; the rest rely on a stand-alone driver.
- ?? Municipal labor contracts call for time and a half for overtime hours worked during this hypothetical event (given the time of day and day of week) in all but one community, in which double time is paid.

Policies

- ?? Most communities rely on **unwritten** operational policies to guide their snow removal and control responses.

Notwithstanding the above, the lack of standardization is readily apparent when you consider the following results:

- ?? Material ratios vary greatly, with communities making use of 2:1, 3:1, 4:1, 5:1, 6:1, 7:1, 7:2 or 8:1 sand/salt mixtures.

- ?? Response durations range from as few as 2.5 hours after snow fall ceases to as many as twelve. Seven hours is the average. Only a handful of communities would finish plowing before rush hour/school bus routes commence under the hypothetical scenario (which calls for the storm to end at 1:00 a.m.).
- ?? Net costs per road mile span from a low of \$70.50 to a high of \$409.24.
- ?? Some 59% of the respondents are not required to wait until a prescribed level of snow accumulates before commencing their snow plow work. The remaining 41% are instructed to delay until anywhere from ¼ of an inch to 2 inches falls.
- ?? The existence of “black roads” policies (written or unwritten) was documented by only 32% of the responding communities.
- ?? The average amount of time required to complete an assigned route with one pass varied markedly across communities—with towns indicating anywhere from 1 hour to upwards of six hours.

Despite the significant number of competing policies and practices revealed by the exercise, it is hoped that meaningful comparisons can still be made across “like” communities to aid decision makers in evaluating their respective departmental approaches. To this end, the twenty-two participating municipalities have been grouped together into three separate clusters--based on 2000 Census population statistics--to facilitate analyses. While it should be noted that other town-specific characteristics clearly impact the scope of any resulting snow removal operation (e.g., population density, number of road miles maintained, etc.), it was decided that population figures provide the most reasonable basis for dividing the respondent pool. *Table I* below, therefore, identifies the members of each cluster.

Table I: Clustered Analyses*

MUNICIPALITY	POPULATION	DENSITY	
East Granby	4,745	272	Cluster #1 (less than 15,000 residents)
Bolton	5,017	348	
Hebron	8,610	233	
Canton	8,840	360	
Granby	10,347	254	
Somers	10,417	368	
Windsor Locks	12,043	1,334	
Ellington	12,921	380	

Avon	15,832	685	Cluster #2 (between 15,000 and 30,000 residents)
Stonington	17,906	463	
Rocky Hill	17,966	1,336	
Berlin	18,215	689	
Waterford	19,152	585	
Simsbury	23,234	686	
Wethersfield	26,271	2,120	
Windsor	28,237	953	
Newington	29,306	2,225	
Southington	39,728	1,104	
Middletown	43,167	1,056	
East Hartford	49,575	2,751	
West Hartford	63,589	2,893	
Hartford	121,578	7,028	

*For towns that believe they should fall within another cluster, the responses for all participating communities have been published herein to allow for independent follow-up analyses. See attached appendices.

Quantifying the Resources Employed

As part of the exercise, participants were asked to provide **basic** information to allow CRCOG staff to calculate the general fund direct costs associated with their projected storm responses. The number of full-time employees to be utilized was requested, along with the regular and overtime rates for each position (e.g., supervisors, drivers, riders, etc.). Indirect personnel costs, covering pension, health, Social Security, and Worker’s Compensation benefits, however, were not included.

In terms of equipment costs, respondents were charged with identifying the various types of vehicles that would be used during the storm operation (e.g., plows, sanders, front-end loaders, etc.), the number of each kind required, whether each piece was owned or rented, and associated rental rates, as applicable. Note that routine maintenance and repair costs for town-owned equipment were also considered to be outside the scope of this study.

Finally, materials information, including the amount of sand, salt and other ice-fighting chemicals to be used and the unit prices currently paid by each community, was furnished. Fuel costs, though, were not requested.

Appendix B, entitled “Costing Analyses: Staffing, Equipment and Materials”, summarizes by cluster the breakdown of projected expenses and includes net costs per resident and per road mile for each

community. The average total costs recorded by respondents in clusters #1, #2 and #3 were \$7,778, \$17,669 and \$56,186 respectively.

Companion exhibits (Appendices C and D), covering labor rates and a fleet response review, provide a more complete picture of the operations in each town and what elements may inflate departmental costs.

A review of the information presented in this section (and in the above-referenced exhibits) gives rise to a number of operational questions that may warrant further consideration by management/supervisory staff in each community:

- ?? Are there alternative ice fighting chemicals that could be used to enhance removal activities and save taxpayer dollars? Five communities indicated that they would make use of “alternative” chemical agents during the storm in question, including Ice Ban Magic (at \$1.10/gallon), liquid calcium (at \$0.62, \$0.71, or \$0.86/gallon—depending on the town), and salt brine (at \$.08/gallon). Note that the viability of these products as substitutes/supplements for more traditional materials, in terms of their effectiveness, the environmental implications associated with their use and general road wear-and-tear issues, was not evaluated as part of the study.
- ?? Can any of the ice-fighting materials be purchased as part of a cooperative venture (i.e., through the State of CT) at reduced rates, given the vast pricing disparities seen across communities?
- ?? Are all towns making use of the most efficient and effective sand/salt ratios?
- ?? Have routes been examined to minimize the extent of “deadheading” (i.e., the time during which the truck is in motion but the plow blade is not in service)?
- ?? Are certain town labor contracts comparatively generous, while others trail behind prevailing wage rates for similar positions in other towns?
- ?? Are riders necessary for snow removal operations (based on the equipment used), given that only 3 of the 22 participating communities make use of them?
- ?? Can select communities secure more competitive rates for rental equipment furnished with an operator? Appendix E, entitled “Equipment Rental Rates Comparative”, illustrates the broad spectrum of rates currently paid by CRPC towns.

Additional information addressing several of the above-stated issues is presented in the sections that follow.

Identifying Operational Policies

As stated previously, while few communities to date have adopted formal, written policies governing their snow removal and control operations, many do appear to rely on informal procedural guidelines to direct their individual town responses. These guidelines, however official in nature, vary markedly across communities. A summary highlighting the spectrum of responses submitted by the participants is presented below:

- ?? Only ten of the twenty-two communities have policies that require a specific percentage of main roadways remain open at all times. Six of the ten boast a 100% standard, while the remaining four require 35%, 33% or 20% of their main arteries be classified as open at all times.
- ?? In terms of prioritizing areas for sanding operations, hills, intersections and curves ranked first, second and third respectively. Other “high risk” locations identified for a tier-one sanding response included mountainous roads, bus stop paths, school streets, town centers, hospital routes and main arteries.
- ?? Only one community specified a target timeframe for reaching the “black roads” standard--approximately 6 hours following a storm’s completion. Bare pavement standards appear to be more loosely employed by a handful of other towns, as they are armed with directives to simply attain/maintain the standard as soon, and for as long, as possible.

The fact that so few communities have elected to codify in writing their own operational policies may make it more difficult to establish broad-based regional standards, should such a course of action be pursued as a follow up to this exercise. Guidance concerning the breadth of such written policies (local or regional) should be sought from town attorneys in order to limit liability exposures. State transportation manuals may also prove to be informative resources.

For example, ConnDOT annually publishes a Snow and Ice Policy Manual that outlines: general operating procedures; the specific usage of snow and ice materials; equipment readiness protocols; and spreading and plowing activities. In support of its mission to keep State roads *reasonably safe and passable* during and after winter storm conditions, the Manual sets forth the following procedures: (1) to use a **7:2** sand to salt ratio as the primary mix on all two-lane highways and ramps, with straight salt to be applied to all multi-lane systems and straight sand to be applied when abrasives are required; (2) to apply de-icing (chloride

and abrasive) materials as soon as enough accumulation is present to prevent materials from being blown off; and (3) to achieve “near bare pavement” results.

In addition, the Minnesota Department of Transportation’s (Mn/DOT) Draft Maintenance Manual, dated February 21, 2001, contains model time periods for achieving bare lanes following the end of a storm event. These benchmarks are known as Target Regain Times. To comply with this performance model, the Department develops individual storm responses to achieve the prescribed goals for all roadway classifications. See Table I below.

**Table I (adapted from the MN/DOT Draft Maintenance Manual)
BARE LANE INDICATOR GUIDELINES**

Classification	AADT*	Target Regain Time	Bare Lane Description
Super Commuter	+30,000	1-3 hours	Bare Lanes are defined the same for all classifications as follows: All driving lanes are free of snow and ice between the outer edges of the wheel paths and have less than 1 inch of accumulation on the center of the roadway.
Urban Commuter	10,000-30,000	2-5 hours	
Rural Commuter	2,000-10,000	4-9 hours	
Primary	800-2,000	6-12 hours	
Secondary	Under 800	9-36 hours	

*Average Annual Daily Traffic

Considering Less Traditional Strategies for Enhancing Operations

Up to this point, the information presented herein has principally focused on documenting how each participant would have responded to a hypothetical storm event, given prevailing operational policies and typical resource allocation procedures. Again, this was done for the purposes of facilitating comparisons across like communities and identifying “best practices”. However, in an effort to engage the public works community in a more comprehensive dialogue about strategies for increasing operating efficiencies and raising effectiveness levels, it was

recommended that this report also make mention of less traditional tools that have not yet been embraced by the towns in the Capitol Region. What follows, therefore, is a short list of ideas that may be worthy of consideration by the participants given their employment elsewhere.

GIS-Based Routing Programs

A number of companies now offer route optimization software that relies on GIS technology to plot routes for different types of snow emergencies, analyze completion and travel times, and estimate material usage. The software is designed to help departments balance their cycle times, reduce deadheading and ultimately save money by covering the same area in less time and with fewer trucks.

Communities interested in investigating the merits of these packages and related products can look to AI Solutions, Enginuity Alliance and the Caliper Corporation for sample offerings. (Note that CRCOG does not endorse any of the aforementioned companies or their respective products, but only references them herein to help towns initiate a product search.)

Anti-Icing Methods

As stated above, only five of the participating communities included “alternative chemical agents”, like Ice Ban Magic, liquid calcium and salt brine as part of their proposed storm response, while the rest of the pool indicated that it would rely solely on a combination of sand and salt. However, other areas of the country have embraced more extensive anti-icing strategies to enhance their winter maintenance programs, and the Federal Highway Administration has produced several resource materials on the topic. Specifically, an eight-minute video is available entitled “The Next Generation of Snow and Ice Control”, which compares an agency that waits for a snowstorm to hit and one that is proactive and deploys anti-icing efforts before the storm begins. The video’s intent is to demonstrate the value of anti-icing and how this technique can save departments time and money.

In addition, the FHWA issued the “Manual of Practice for an Effective Anti-icing Program: A Guide for Highway Winter Maintenance Personnel” in 1996, which includes an overview of anti-icing practices, a discussion on solid and liquid chemical options, related equipment needs, and application recommendations. It can be downloaded off of the web at www.fhwa.dot.gov/reports/mopeap/mop0296a.htm.

Snow Insurance

Though not directly related to snow and ice removal and control activities, snow insurance has been touted as a means for communities to cap their snow removal budgets in the wake of **above average**

snowfall. Coverable costs may include snow removal, plowing, sanding, overtime, supervision, equipment repairs and maintenance. Towns interested in considering the merits of this tool are advised to contact their risk management personnel directly.

Examining Next Steps

It is hoped that the information provided herein, while more descriptive than prescriptive in nature, can be used as a point of departure for additional project work in this arena. An informational exchange forum has already been suggested as the logical next step, to both allow select towns to showcase their operations (what they do and why) and to permit the participant group as a whole to identify possible effectiveness analyses that might be undertaken as part of a follow-up project.

In addition, communities are encouraged to consider the operational questions listed on page 7 of this report to help them evaluate their current snow removal and control operations and perhaps make strategic modifications to improve them.