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## RESULTS SUMMARY

Researchers expanded the toolkit developed in Phase I to calculate the costs and benefits of key winter maintenance practices, equipment options and operations strategies to include more high-priority items. Other enhancements include a report export function and a new user management system.

# ONLINE WINTER MAINTENANCE COST-BENEFIT CALCULATOR, PHASE II

In today's economic and cultural climate, winter maintenance programs are under intense pressure to constrain costs. Practitioners understand that investment in new tools and practices is necessary to provide the best level of service possible at reasonable costs, but the public—and decision-makers acting on their behalf—need to have the value of these expenditures demonstrated up front.

## Need for Research

In 2010 Clear Roads developed the [Cost-Benefit Analysis Toolkit](#), a web-based tool practitioners can use to calculate the costs and benefits of key winter maintenance practices, equipment options and operations strategies. This toolkit proved valuable to practitioners, but it was limited in scope to 11 specific items selected based on a survey of winter maintenance professionals and the Clear Roads Technical Advisory Committee.

Winter maintenance practitioners needed a way to conduct cost-benefit analyses on additional tools as well, so Clear Roads initiated a second phase of research to expand the toolkit. This update also provided the opportunity to implement several refinements to the toolkit to improve its usability based on user feedback.

## Objectives and Methodology

The research process for this phase of the project was similar to that of Phase I. Investigators surveyed winter maintenance professionals via Clear Roads' email list and the Snow and Ice listserv to identify the 10 items practitioners were most interested in adding to the cost-benefit toolkit. Researchers received 54 responses from 28 states and Canadian provinces.

Next, investigators collected information about tangible and intangible costs, benefits and effectiveness for each of the items identified for inclusion in the toolkit.

Finally, in addition to introducing refinements that improved usability, researchers updated the toolkit by adding cost-benefit analysis capabilities for the 10 new items. For each item, this entailed accounting for costs and benefits—

## PROJECT DETAILS

**Project Title:** Development of a Toolkit for Cost-Benefit Analysis of Specific Winter Maintenance Practices, Equipment and Operations: Phase 2

**Project Number:** No. CR11-01

**Project Cost:** \$109,999.00

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**Initial Costs Worksheet - Slurries**

Items	Unit rate	# of units	Unit	Amount (\$)	Notes
Salt slurry generator cost					
Installation cost (additional time)		0	vehicles	0	
Other 1 (define)					
Other 2 (define)					
<b>Salvage cost per spreader</b>					
Minus cost or salvage value for standard spreader equipment			vehicles		
<b>Total initial expenditure</b>				0	

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both monetary and more intangible—to the purchasing agency, motorists and society in general. They also made enhancements to the toolkit interface and underlying code.

## Results

Based on survey feedback, researchers added the following winter maintenance items to the toolkit:

- Flexible vs. traditional blades
- Prewetting at the spreader
- Spreader calibration
- Slurries
- Tow Plows
- Contracted vs. state-owned trucks
- Open-loop vs. closed-loop spreader controls
- Cameras for monitoring remote site locations
- Laser guides
- Tailgate vs. hopper spreaders

As in the original toolkit, the analysis for each tool is built over a series of five Web pages. The user defines project parameters on the first page, and enters initial and annual costs specific to the agency on the second. The third page presents a list of the range of benefits associated with the tool, and the user inputs data necessary to quantify those benefits on the fourth page. The final page presents the results, including an overview of costs and benefits and a benefit-cost ratio. Ratios greater than 1.0 are generally desirable, although lower ratios may be used to justify an investment if there are significant intangible benefits that are not quantified in the ratio.

Phase II of the toolkit introduced the capability to export cost-benefit reports as Word or HTML files. Researchers also implemented a user management system, which allows a user to start an analysis, save it, and come back later to complete it or change values. This system also allows users

to access their previously saved analyses. Finally, researchers updated the toolkit's content management system to help ensure usability across browsers.

## Benefits and Further Research

Many agencies used Phase I of the toolkit to help justify winter maintenance investments, and that trend has continued with the additional analyses available in Phase II. For example, both Massachusetts DOT and Wyoming DOT have used the toolkit to evaluate the return on investment for Tow Plow purchases. The toolkit produces reports that show local costs and benefits in easy-to-understand terms. It is also intuitive enough that nonpractitioners can input numbers, so while legislators and upper managers might not run a full analysis, they can use the toolkit to get a feel for the full range of winter maintenance benefits and costs.

One of the major challenges in conducting cost-benefit analyses in winter maintenance is that many of the emerging tools for which the analyses would be especially valuable have not yet been thoroughly studied. As a result, there is not an extensive body of research that can be used to calculate their impacts. In the future, the toolkit may help improve understanding of these impacts, because users input real-world data as they run their analyses. Adapting this detailed information to facilitate a broader understanding of costs and benefits would require a mechanism to extract and use that information, as well as a method for distinguishing actual data from numbers inputted simply to test the system.

While there are not yet specific plans for further development of the toolkit, the Clear Roads survey showed that there are several other winter maintenance practices, equipment options and operational strategies that users would like to see added. These potential topics include Fixed Automated Spray Technology, snow fences (both living and temporary), and agricultural-based chemicals vs. non-agricultural-based chemicals.

“The toolkit corrals lots of data and puts them into one place in a concise and clear manner. All of the information is there to help users determine which investments are a good value.”

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