CLEAR ROADS
research for winter highway maintenance

RESEARCH BRIEF

RESULTS SUMMARY

Researchers developed a software tool to estimate increased costs of roadway snow and ice control operations required for new roadway additions and configurations. These costs can then be considered during the planning process of new road projects.

PROJECT DETAILS

Project Title: Quantifying the Impact That New Capital Projects Will Have on Roadway Snow and Ice Control Operations

Project Number: CR14-02

Project Cost: $145,622

Report Date: November 2017

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FEBRUARY 2018

QUANTIFYING THE IMPACT OF NEW ROAD PROJECTS ON WINTER MAINTENANCE

In recent years, an increase in extreme weather events has overburdened budgets for roadway snow and ice control (RSIC) operations in Snow Belt states. Winter maintenance operations in many state departments of transportation (DOTs) have been stretched thin in the face of both severe weather and new road projects that are constructed without adequately considering associated RSIC needs. A new cost estimating and allocation decision tool will allow DOTs to more closely estimate the RSIC budget increases needed to cover new road projects.

Need for Research

DOTs needed a tool to quantify the expected impacts—time and cost—that new road projects would have on RSIC operations. Explicit RSIC costs could then be included in transportation project budget priorities since winter maintenance operations make up a large annual cost for many states.

Objectives and Methodology

The research assessed the effects of two general project categories: additions of capacity to existing roadways and new roadway configurations. The planned computer model and calculation tool would quantify how each category would affect total vehicle hours of travel and associated needs for RSIC equipment and materials. A storm severity classification feature would estimate route salt needs for four storm levels in the computer model.

To develop a fully integrated RSIC model for this project, researchers used an existing RSIC allocation and routing computer model that had been created for Vermont's transportation agency. They expanded the model's functionality by integrating a travel model, which incorporated traffic congestion, and a submodel for calculating which roads are most critical for traffic flow. Weather data was also included in the model since it represents the demand for salt during a winter storm.

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The intersection of US-2 and US-3 in Lancaster, N.H., as (a) a stop- and yield-controlled intersection and (b) a roundabout. The RSIC needs are different for each.

Using representative transportation improvement projects as case studies, researchers applied the computer model to compare effort and cost of RSIC operations before and after seven roadway projects: two in New Hampshire, two in Minnesota and three in Vermont. However, only one New Hampshire project and the three Vermont projects provided usable data. So three additional projects from Vermont were added to maintain the number of case studies at seven.

Results

Researchers used the computer model and GPS field data to compare the required RSIC efforts in the seven case studies both with and without the new roadway projects. The results were very clear: Most new road projects resulted in a greater need for RSIC resources. The model was able to determine the cost of each new road configuration in terms of time, number of trucks, vehicle hours, materials and, ultimately, dollars.

Researchers summarized the increased RSIC efforts needed for the following roadway configurations: new roads in urban, suburban and rural areas; new left-turn lanes in rural areas; highway lane additions in rural areas; and conversion of a stop- and yield-controlled intersection to a roundabout. For example, adding a new suburban roadway with one lane in either direction could add 266 RSIC maintenance minutes per mile. Generally, RSIC operations on road expansions in suburban areas required much more additional effort than those in urban areas, with more travel time, time spent crossing roads already plowed, as well as the need for turnarounds for large equipment. Roundabouts, though at times problematic, increase costs by only a small amount over a stop- and yield-controlled intersection.

Finally, researchers distilled their extensive computer modeling work into a simplified, easily learned Excel-based calculation tool for DOT RSIC maintenance users. They populated the tool with outputs from their complex RSIC modeling and also created fields in which users adjust the default input data (such as cost of salt or cost of gasoline). With the tool, maintenance agencies will be able to enter the specifications for a proposed road project and quickly learn how much additional time, plow assets and dollars the new project will require for RSIC operations once it is completed.

Benefits and Further Research

The greatest benefit from this project is the ability of DOT maintenance groups to determine and present data-supported information about costs of future RSIC operations. Requests for RSIC budget increases will no longer be based upon rough estimates or anecdotal information. Instead, RSIC costs will be clear, with defensible data supporting the need for increases. In addition, the tool could allow more interdepartmental communication: Transportation planners familiar with the tool could design new roadway configurations with RSIC operations constraints and costs in mind much earlier in the planning process.

"With this tool, RSIC maintenance departments will be able to produce the data-supported information they need to justify requests for additional plow resources due to the changes designed in the project. Everything becomes very clear—no more guesses, no more anecdotal estimates."

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Produced by CTC & Associates LLC on behalf of the Clear Roads pooled fund project #TPF-5(353), led by the Minnesota Department of Transportation.