Innovative uses of Maintenance Decision Support Systems as a Research Tool for Analysing Winter Road Salt Usage

Amec Foster Wheeler Met-Ocean Services - Ted Reeler – January 2016

Road Weather Information Systems (RWIS) are comprised of networks of roadside weather stations which provide winter road maintenance crews with real time data on road conditions. They also enable the modelling of pavement temperature forecasts which predict when the roads will freeze. Maintenance Decision Support Systems (MDSS) go a step further to provide road maintenance crews with recommendations for the efficient treatment of winter roads during approaching storms based on each organization's own winter road maintenance rules of practice.

MDSS analyses and tracks road temperature; snow on the road; snow precipitation rate; available liquid on the road; available chemicals on the road; road type; traffic volumes; weather conditions; road conditions; and mobility on the road. The underlying algorithms and science used in MDSS are industry recognized and are derived from many years of research and development, funded by the Federal Highway Administration (FHWA), performed by NCAR and 4 other labs and refined since by industry organizations including Amec Foster Wheeler.

Amec Foster Wheeler, in collaboration with several of its winter road maintenance clients, have utilized MDSS in other innovative ways as a research diagnostic tool.

One line of research has been to post process selected past winter seasons to estimate how much salt, or chemical, could have been used on the winter roads during each of these winter seasons. Archived weather and RWIS data are used to re-create road conditions during the winter storms. Recommended road treatments are generated for each winter storm over the season using the rules of practice which are specific to a road maintenance department. The results allow road maintenance departments to determine if reasonable quantities of salt or chemicals are being used in practice. It is important to realize that in practice there are real world factors which affect the decisions of the road maintenance crews. Maintenance crews with years of experience know about troublesome roads and dangerous intersections. Safety margins are often applied in practice to counter forecast uncertainty. Nevertheless, the results of using MDSS as a post processing tool provide an important yardstick against which comparisons can be made for different storms in different seasons across different areas.

Another innovative application has been to use MDSS as a research tool which allows an organization to explore the sensitivity of changing their current rules of practice; to achieve better times-to-bare-pavement; and whether smarter or different rules of practice may or may not lead to reductions in salt usage over the course of a winter season. Furthermore, storms can be analysed over several different seasons and in rural and urban areas to determine the impact of changing rules of practice.

While MDSS has many assumptions in its algorithms, it also has a powerful advantage of applying the winter road maintenance rules of practice of a particular organization in a consistent way. The result is that, instead of having anecdotal comparisons, the results can be turned into measurable quantities, and compared to actual quantities storm over storm and season over season in different geographies across a jurisdiction.