

Topic II “ Snow and Ice Management and its Costs”

Summary on the main topics, issues and future perspectives

A variety of issues have been presented and discussed within the topic “ Snow and Ice Management and its Costs”. Keywords were: Maintenance management and Management systems, Budgeting, Information management, Service level, Heavy snowfall areas, Monitoring methods, Equipment, Reduction of salt spreading, Salt stock management, Snow Fences, Avalanche protection, Shift management, Personnel training, Winter Index, Cost-benefit and Drivers behaviour, to mention only the most important.

On the management level, computerised systems are becoming a powerful tool for quality assurance, invoicing, payments to subcontractors and for planning and calculation. Some new applications are being developed by the Swedish road administration such as: handling a whole maintenance contract, as a follow up system, direct information via traffic information central and automatic registration of the amount of spread salt on different stretches.

The same Administration has developed a new winter index, based on 680 RWIS-stations as well as data provided by the meteorological and hydrological services. A Mesoscale Analysis System, is used to calculate the amount of precipitation. The new winter index can be used both for cost and salt consumption follow-up, and as payment basis for contracted winter road maintenance.

Snow and ice control tend to become more centralised. In Northern Germany a centralised winter road maintenance unit has been set up to co-ordinate the activities of 14 maintenance centres, covering 1000 km of motorways. All necessary information is collected, analysed and all decisions for action emanate from this unit. The benefits after 4 years of experience are convincing: a more economical monitoring of road conditions, centralised access to information, better co-ordination of the standby service, a better co-ordinated preventive treatment of the road surface, reduced differences in the state of the roads from one district to another and finally an overall cost reduction.

Concerning equipment, a study in Germany recommends the number of necessary vehicles for winter maintenance operations on 2-3 lane motorways. For a stretch of 70 km, the ideal length of motorway controlled by a maintenance centre, 4 heavy trucks and 2 heavy duty vehicles are optimal. 2 trucks working in squadron on the motorway and 1 heavy vehicle doing the junctions and additional lanes. With this equipment a tour time of 2 hours can be achieved if the maintenance centre is centrally located. If not, the setting up of supplementary salt barns or silos are desirable.

Reduction of salt spreading is still an important issue. Two approaches have been presented An “anti-icing chemical spraying map” in Japan and a strategy of complete mechanical snow removing in Finland, based on correct timing of salting, precise weather forecast, no salting when the friction was above a certain level and preventive salting only when a snowstorm was announced. An impressive overall reduction of 40 % has been achieved, without increasing the number of accidents

Monitoring the road surface conditions to intervene accordingly has become standard on many motorway networks. Several examples have been presented, including one in Japan, using stationary images of the road.

There are however also limits. In a territory like Canada, choosing an RWIS for a road network of some 30'000 km is a huge task. Besides the technology, the geographic realities, the support and the implication of contractors have to be considered, and also the necessary substantial training efforts. The final conclusion in this case was: redefining the process in a socio-psychological approach rather than technology oriented. The decision maker must remain in the centre of the process.

Service levels have been defined in various countries.

In Hokkaido 3 target levels have been defined, according to the climatic regions. The use of thawing agents or abrasives depends mainly on air temperature and hours of sunshine in the respective climatic zone. Further classification in an application matrix include: daily traffic volume and area type (urban, flat, mountainous).

Minnesota has implemented “maintenance business planning techniques” for the 1999-2000 winter season. It included the concept of “loss of bare pavement regain time” after a storm event. Performance target values for bare pavement by road class were developed, taking into account past performance results, supervisor and field worker experience, market research and environmental factors. As example the target values for bare pavement vary from 1.5 to 3 hours for super and urban commuters and 4 hours for rural commuters.

Germany introduces a countrywide uniform level of service for motorways. The strategy is based on: RWIS, prewetted salt, de-icing spraying systems, warnings for road users and measures in case of traffic congestion and collapses, comprising driver info and relief service.

In Estonia in the past years several measures have been taken to ensure safe and uniform road conditions on national roads. All national roads are now under snow and ice control, advanced equipment for anti-skidding treatment as well as preventive technology are used, a RWIS has been developed and management reform has been started. In the near future road maintenance will be transferred to the private sector.

A presentation from India confronted us with Snow and ice management in the Himalayas, a most difficult and challenging task, due to terrain, climatic conditions and limited resources. Winter temperatures are usually -30°C , snowfall is extreme, each major storm is expected to deposit as much as 190 cm. There are more than 100'000 avalanches, per winter, so most of the roads face the avalanche risk. There is snow drift, there is icing due to diurnal temperature variations and finally there is the excess water during the frost melting period which flows with tremendous velocity over the pavement, causing huge damage.

The development of an integrated technology suitable to Himalayan terrain is in progress. The author expressed an urgent need for knowledge exchange with other countries.

Heavy snowfall areas also exist in Western and Northern Japan, as we are witnessing. In the Hokuriko region 20 m total annual snowfall is not unusual. A road surface information system and a snowfall prediction system have been set up, serving the maintenance centre and the road user. The system allows an estimation of the vehicle speed and the expected travel time, an information given to the road users.

Avalanches are a constant threat in mountainous regions and therefore protection devices have been set up in many places. In Norway an efficiency evaluation on these devices is presently being carried out and the results are interesting indeed. The efficiency, defined as the relation between the number of road closures before and after protection, reaches 90 % for wide road ditches and for avalanche detection, 89 % for blasting, 75 % for supporting structures and 68 % for culvert-type sheds.

Snow fences are used to reduce the quantity of drifting snow on the road and thus increases the safety and the visibility for the road user.

In designing the fences the height, the porosity and the gap between the fence and the ground are basic parameters. In a wind tunnel experiment 11 different types of structural snow fences from 8 countries were tested. The results show a variation between 0.8 and 4.5 in normalised catch per unit width of fence. The drift lengths extended from 1 to 26 L/H-ratio on the leeward side.

Budgeting and cost remain a key preoccupation of the winter maintenance manager. To hedge the risk of cost fluctuation influenced by the weather, the city of Sapporo plans to introduce a snow removal insurance.

Means to reduce cost among others are: training of the staff, bearing in mind that winter maintenance can represent up to a third of the annual budget. In Norway, an interactive training program on PC is used for staff training. Another means is shift management, as “being ready for intervention” is a considerable part of the staff schedule and has to be paid or compensated. An other attempt is salt stock management, based on the fact that salt prices are lower in summer. Parameters here are: the defined service levels and the empirical spread and weather data.

Several presentations from Japan showed, that cost/benefit is an important issue in this country. It would go too far to enter into details. Let me just list some of the approaches:

- a simple analysis based on land value in urbanised areas in heavy snow regions
- punctuality and improving driving comfort
- measure the benefit of providing road traffic information
- Willingness To Pay of Sapporo citizens for snow removal services

Another issue was “drivers behaviour. Two Japanese studies analysed winter travel speed on 31 pass sections and overtaking of cars on slippery roads.

My last keyword is information management. A presentation from the United States showed, that information should be tailored to meet specific needs. The use of an information management system has the potential to improve and optimise winter service performance. Such a system categorises the information in static versus. dynamic and defined versus. measured information. Further evaluation are timeliness, accuracy and relevance. 4 different end users are defined: Maintenance truck operators, road system managers, road users and automated systems.

Future developments

Future developments are to be expected on several levels. Monitoring methods with combined management systems will become more sophisticated. A management system already implemented on a highway in Northern Italy uses a satellite localisation of snow and ice removing vehicles. The system is based on a self-learning programme, which also automatically doses the thawing agents for different stretches of the road. The operator in the centre disposes at every moment of a map which gives the state of the road surface and the state of treatment.

The introduction of standardised service levels will continue, as such an attempt will help the maintenance services to optimise time, cost and equipment. For the road user, standardised surface conditions will lower the element of surprise in driving in winter and thus contribute to traffic safety.

It has however to be stressed, as one speaker said, that maintaining traffic safety and traffic flow is a responsibility shared by winter maintenance authorities and road users.