

Proposal for New Winter Road Maintenance Strategy: MINSALT

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The MINSALT project has resulted in a proposal for a new winter maintenance strategy that shows how winter road maintenance can be organized so that its objectives can be attained. By adopting the proposed strategy, it is possible to reduce salt consumption. The overall goal of road maintenance is to help maintain the country's total resources at a high level of efficiency. The objectives can be broken down into several road maintenance aims, including a high standard of traffic safety, good trafficability and high degree of availability, low vehicle costs, and a good environment. Ways that these aims can be achieved on rural areas and in municipalities in the winter are explained. Proposed measures, methods, and resources are also presented.

Salt is satisfactory as a means of improving skid resistance, but it also causes problems, such as increased corrosion on vehicles and roadside structures of steel and damage to concrete structures, trees, and other vegetation, especially in municipalities. The use of salt (or sodium chloride) as a deicing material is therefore being questioned more and more by the road users, the general public, and politicians.

For this reason, the Ministry of Transport and Communications commissioned the Swedish National Road Administration, the Swedish Association of Local Authorities, and the Swedish Road and Traffic Research Institute to draw up a detailed research program aimed at reducing the harmful effects of salt in winter road maintenance. This research program, which was implemented during 1985–1991, is called MINSALT.

The purpose of the MINSALT project was to find out whether and how the harmful effects of salt in winter road maintenance could be reduced without a deterioration in traffic safety. The Ministry of Transport and Communications decided on three ways of minimizing the harmful effects of salt:

1. Extend the regions in which salt is not used.
2. Use new methods for snow and ice control.
3. Devise a new strategy for snow and ice control.

PROPOSAL

The MINSALT project has resulted in a proposal for a new winter road maintenance strategy that, in the light of the results of research and the experience gained from the MINSALT project, shows how winter road maintenance can be organized so that its objectives can be attained. By adopting the pro-

posed strategy, it is possible to reduce salt consumption by about 20 to 40 percent.

The overall objective of road maintenance is to help maintain the country's total resources at a high level of efficiency. This objective can be broken down into the following aims:

- A high standard of traffic safety
- Good trafficability and a high degree of availability
- Low vehicle costs
- A good environment

RURAL AREAS

In rural areas the aims can be achieved by meeting the standard requirements (described in functional terms) of roads in the winter given in Table 1. As for pedestrian pavements and bicycle paths, they should be even, nonslippery, and free from loose snow.

The standard requirements mean that

- Road users must be informed about the winter road maintenance objectives of the National Road Administration.
- Road users must be informed about current road maintenance measures and the latest weather, road, and traffic conditions.
- The standard of winter road maintenance should be so uniform that road users do not notice the difference between road maintenance areas, districts, and counties.
- The standard of maintaining pedestrian and bicycle paths should be such that pedestrians and cyclists do not prefer to use the road.

National and Regional Roads

The standard requirements cannot always be met on account of prevailing traffic and weather conditions, but as far as is practicable, the following requirements apply to national and regional roads. If there is a danger of slippery road conditions, antiskid measures should be taken to prevent them. Deicing and antiskid measures should be carried out before peak traffic periods, and the time for these measures on national and regional roads should be 1 and 2 hr, respectively.

Snow deeper than 3 cm (1.2 in.) should not be allowed to remain on the road during a snowfall, and after the snow has stopped, the road should be free from snow in no more than 2 hr for the national roads and 3 hr for the regional roads. Strings of slush should not be left on the road. Snow should

TABLE 1 Standard Requirements for Rural Areas

Functional Goal	Road		
	National	Regional	Local
Uniform standard of trafficability	X	X	X
Dry road, free from snow and ice	X	X	
Even surface, free from loose snow			X
Good road user information and information on weather and road conditions	X	X	X

be cleared from the hard shoulder when the roadway is free from snow.

Local Roads

As far as is practicable, the following requirements apply to local roads. When precipitation causes extreme slipperiness, the roadway should no longer be slippery within 4 hr after the precipitation has stopped. Snow deeper than 8 cm (3.2 in.) should not be allowed to remain on the road during the snowfall. The roadway should be cleared from snow not more than 8 hr after the snow stopped falling.

Procedures

Functional Requirements

The following procedures can be adopted to meet the functional requirements, although local conditions may call for other solutions:

- Neighboring road maintenance area should be contacted each time snow-clearing or deicing measures are undertaken.
- If possible, winter road maintenance boundaries between neighboring road maintenance areas should be located where traffic speeds are lower, such as intersections, interchanges, or population centers, or where a safe turning space can be arranged.
- When planning deicing routes, the time difference between units meeting at the boundary should not exceed 30 min for the salted road network. Coordination between different units should take place. Practical considerations rather than administrative boundaries should be the determining factor, so that "invisible" boundaries are reached. If conditions are favorable for overlapping, such a measure should be considered.

Deicing and Snow-Clearing Methods

Adoption of the following measures, methods, and resources is proposed. It is important to use the right method at the

right time. Where chemical deicing is concerned, the method used should be the one with the lowest salt consumption. For preventive salting, the salt should always be pretreated with 80 to 100 L of water per tonne of salt (22 to 27 gal of water per 2,200 lb of salt) if equipment for spreading a saline solution or pretreating salt with a saline solution is not available. This means that the dry salt is pretreated in a simpler manner by spraying a saline solution or water over it as it is loaded onto the spreading vehicle. Pretreated salt should not be spread wider than 4 m (4.3 yd), regardless of the road width, because of large salt losses in connection with wider spreading. The application rate compensates for the actual width to be deiced.

Salting in conjunction with snowplowing should be carried out only when there is a danger of compaction or freezing. When salting and snowplowing are combined, the salt should be spread only on the width of the road that has been cleared of snow.

Chemical deicing should normally not be done on local roads, as the standard requirements for local roads says. If possible, salt-free abrasives such as crushed stone aggregate of 2 to 5 mm (0.08 to 0.20 in.) should be used. The lowest temperatures for chemical deicing should be -12°C (10°F) on national roads, -8°C (18°F) on regional roads, and -3°C (27°F) on local roads. At temperatures lower than these, the material with the best adhesion, having regard to durability and availability, should be chosen.

Sand mixed with salt should not be used when it is possible to use crushed limestone, natural sand, or crushed stone aggregate. If sand mixed with salt is to be used, it should be mixed with 20 to 50 kg of salt per m^3 of sand (22 to 55 lb of salt per 1.3 yd^3), and not later than in July. The longer time taken to melt the salt, the higher the quality of the product.

Snow-clearing equipment should be adapted to the prevailing snow and temperature conditions. Snow should be cleared from the roads as quickly as possible. If possible, salting should be delayed until the snow has stopped falling.

MUNICIPALITIES

Road safety should be of a high standard for all road user categories. To reduce the number of casualties and minimize the cost of accidents to the community, deicing for pedestrians must be given priority. Having good traffic system availability calls for a high standard of deicing of pedestrian paths. Otherwise it will not be possible to satisfy the transportation needs of the elderly and the handicapped. Highly frequented pedestrian routes to bus and tram stops, civic centers, central city areas, and so forth should be even, skidproof, and free from loose snow.

The business sector in particular demands good trafficability on main roads and important streets. In principle, these roads and streets should be deiced by the time the morning rush hour starts and to the same standard and with the same standard requirements as the National Road Administration maintains on adjoining roads. Cooperation between the National Road Administration and the local authorities should therefore be developed, especially in regard to information on weather and road conditions, deicing vehicle turn-outs, and other measures.

Antiskid treatment is highly dependent on good weather information and good forward planning to prevent operational problems. On important through routes and main streets, preventive antiskid measures are an important means of achieving high standards of road safety and trafficability.

A suitable way of carrying out preventive salting is with prewetted salt or a saline solution. This will produce better results with a smaller quantity of salt.

The use of a saline solution should be avoided on icy roads and extremely wet roads and during snowfall. It is important to limit the use of salt wherever possible so that deicing can be carried out in a manner that is least harmful to the environment. Salting should therefore be used primarily as a preventive measure. Salt should not be used to melt snow. Salting in connection with snow clearance should be resorted to only when there is danger of snow compaction. Salt should be used

restrictively on main roads and major streets lined with trees. Care should also be taken when salting near concrete structures.

If dry salt is spread on the roads, salt spreaders on which acceptable application rate settings are possible should be used. As a rule, sand spreaders are not suitable for salting. Salt should not normally be spread on less important main streets. If possible, such streets should be treated with crushed stone aggregate or the like without the admixture of salt. Removing the salt from the sand used for gritting greatly reduces the amount of salt spread on municipal street networks.

Pedestrian and bicycle paths should normally be treated with salt-free materials. Materials that ensure good skid resistance should be chosen for bicycle paths as long as they are not so flaky as to damage bicycle tires. Heated sand might be a good alternative to crushed stone on pedestrian paths.