

# WINTER MAINTENANCE POLICY IN FINLAND

T. Päiviö-Leppänen & A. Leppänen  
Finnish Road Administration, Helsinki, Finland  
tuovi.paivio-leppanen@tiehallinto.fi & anne.leppanen@tiehallinto.fi

## ABSTRACT

The Winter Maintenance Policy of the Finnish Road Administration describes the policies under which Finland's highways are maintained in winter. The previous Policy was adopted in 2001. The new Policy will be adopted from 1 October 2009.

It is emphasised that in situations with changing weather, problematic road conditions will inevitably occur, for which road users must be prepared. However, the starting point of policies on winter maintenance of roads in Finland remains the fact that it must be possible to use all the roads that are the responsibility of the Finnish Road Administration every day throughout the year. The frequency of situations with changing weather is expected to increase due to climate change. The needs of customer groups are taken into account in founding the policies in a diverse way.

The key policies in the winter maintenance of Finland's highways are connected to consistency in service level, taking into account needs of customers and differences in climatic conditions, traffic functionality, cost-efficiency, management of environmental hazards, communication about road conditions and cooperation between road maintenance authorities. Service level will be increased from the present level with respect to the prevention of slipperiness on roads with very high traffic, night time traffic and smoothness and friction requirements for lower traffic roads.

It is emphasised that the actual quality must correspond to the quality ordered from the contractor. This requires a sufficiently efficient and functioning quality assurance system.

## KEYWORDS

WINTER MAINTENANCE / POLICY / SERVICES / QUALITY

## 1. INTRODUCTION

The winter maintenance policy defines the operational level of service for the road network with respect to winter road conditions and traffic. The winter maintenance of the whole road network is based on the policy and the principles presented in it. The policy is applied in different parts of the country according to the local conditions and traffic needs. The objective is to achieve a consistent level of quality throughout the road network, which means that the parts of the road network in different parts of Finland that are similar provide the same possibilities for movement.

The key quality requirements presented in the policy are specified in more detail in separate quality requirements. Local precision maintenance sites are recorded as project-specific specifications to the maintenance contract. Quality requirements and project-specific specifications function as quality assessments of the contractor's work. Winter maintenance is to a great extent a service operation that is tied to the prevailing weather conditions, and cannot be described through quality requirements in all respects. It is important that practical operations follow good principles and contractors strive to achieve

the objectives presented in the winter maintenance policy in a customer-oriented fashion. In addition, it is important that the orderer monitors the implementation of the quality requirements. When practical work is carried out in rapidly changing weather conditions and on the basis of forecasts, it is important that the road maintenance authority can rely on the contractor that is responsible for the project, and that the contractor knows the objectives, operating principles and methods of winter maintenance. Contractors present these in their operating and quality plan.

The total length of the Finnish road network is approximately 78,000 kilometres. Unimportant public roads are converted into private roads in accordance with a procedure agreed separately with the Ministry of Transport and Communications. Traffic is predicted to increase at an annual rate of just under 2%, although the rate of growth is forecast to slow gradually from the 2010s. Traffic has been increasing throughout the country, especially on highways, main roads and regional roads, although the growth stopped in 2008 and the vehicle mileage in the first few months of 2009 has clearly been below average.

Winter maintenance has a major impact on the functionality of the entire traffic system. The vehicle mileage during the winter half of the year (6 months) is approximately 45% of the mileage during the entire year. In many sectors of the economy, the share of transports during the winter months is greater than during the summer time. Society and the economy depend on transports and road traffic and expect traffic to function equally reliably during all seasons and times of the day.

Winter maintenance traffic policies are based upon the premise that most cars use studded tyres. The development of car vehicle technology and tyre quality are expected to reduce the risks resulting from winter weather. Climate warming and the resulting increase in unusual weather phenomena pose a significant new challenge for winter maintenance. This policy is based upon the present traffic regulations concerning winter tyres, for example, and especially studded tyres. The policy also starts from the assumption that the use of salt in antiskid treatment will continue to be possible.

## 2. WINTER TRAFFIC AND CUSTOMER NEEDS FOR WINTER MAINTENANCE

### 2.1. Customer group needs

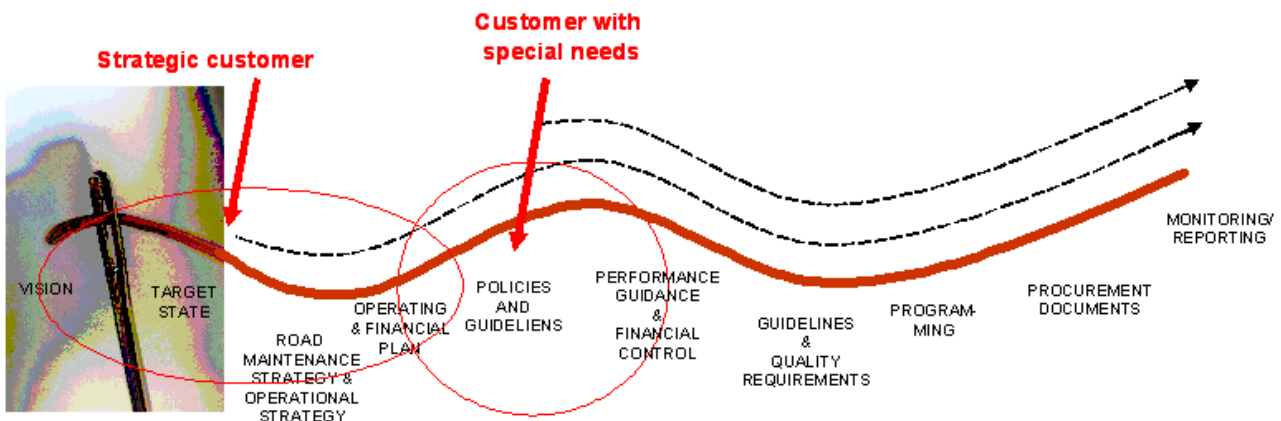


Figure 1 – The needs of customer groups must be taken into account in all stages of road maintenance.

The Finnish Road Administration has classified its customers into different groups on the basis of their needs. The importance of strategic customers in terms of their impact on society is extremely significant and their needs determine the basic service level of the road network also with respect to winter maintenance. The consideration of their needs largely also satisfies the needs of other customer groups, resulting in considerable overall efficiency in relation to the funding used by the Finnish Road Administration.

The strategic customers are comprehensive school children, commuters, providers of transport services for people and goods, the procurement of timber by the forest industry and foreign trade. When determining winter maintenance policies and the service level of the road network, the needs of strategic customers will have been taken into account within the limits of the resources available for winter maintenance.

In addition to strategic customers, the Finnish Road Administration has identified the customer groups with special needs. These customers with special needs include young people (people aged 15–21), the elderly and people with restricted mobility. Customers with special needs also include, for example, people undertaking special transport operations and the transportation companies that transport hazardous substances and their drivers. The needs of these customers with special needs are taken into consideration when planning targeted maintenance on certain roads or stretches of roads or the winter maintenance of lay-bys.

Targeted maintenance means that the maintenance method for the road or stretch of road is changed locally without changing the road's maintenance classification. The change in the maintenance method could be that ploughing is carried out before the first bus services or that the road is sanded more than normal due to heavier holiday or other traffic. These roads subject to targeted maintenance and their maintenance method are specified when planning winter maintenance in the road district, and likewise the maintenance class for the roads. The requirements are included in the contractor documents when putting maintenance out to tender and their implementation is monitored through spot checks during the contract. Customer feedback is another important control factor, especially in targeted maintenance work.

## 2.2. Traffic safety

Road casualties are more frequent on main roads and the sections of main roads with the heaviest traffic. Special attention should be paid to the quality of winter maintenance on main roads with high traffic volumes, although less than half of the winter-time accidents occur on these connections in winter road conditions. Traffic safety surveys covering recent years indicate that winter traffic safety has developed in a positive direction more clearly than summer traffic safety. The positive development has been boosted by the addition of winter speed limits and speed limits during dark hours, as well as automatic speed monitoring, which has been expanded considerably in recent years. The risk of accidents during the night has fallen relatively with respect to the risk of accidents during the day, both in the winter and in summer. During difficult road conditions, especially icy road conditions, the risk of accidents and especially death, is substantially higher than during summer road conditions. The latest surveys indicate that winter maintenance can have an effect especially on the safety of road users who observe traffic rules.

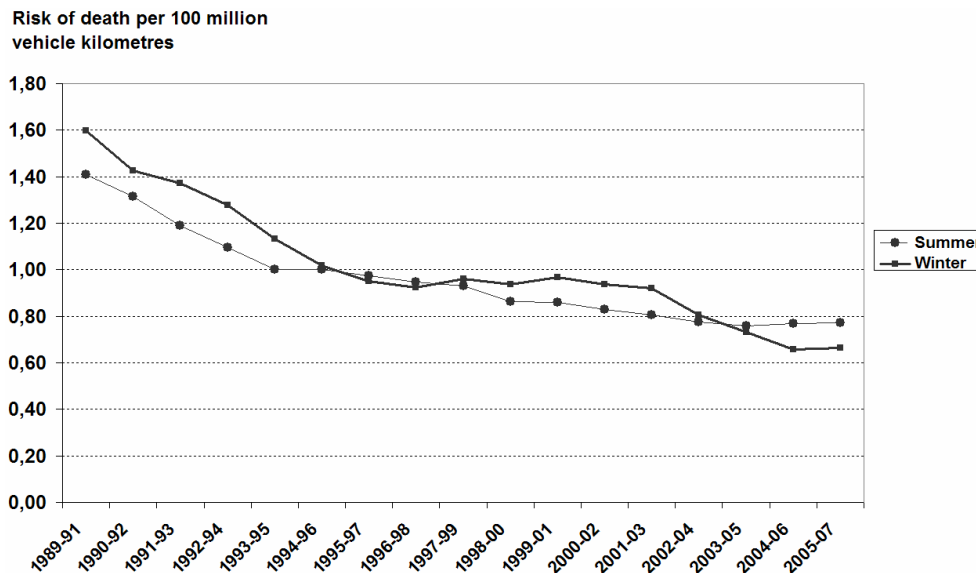


Figure 2 - Risk of a road casualty on the highway during the winter season (October–March) and the summer season (April–October) as a three-year moving average during 1989–2007.

Although the development of safety during winter-time has been positive relative to the change in traffic volumes, achieving traffic safety objectives is very challenging and that is why additional efforts must continue to be made to improve the situation in winter maintenance.

### 2.3. The environment

The use of sodium chloride in antiskid treatment poses a risk to groundwater, especially in Finland and other similar areas where groundwater areas are often small in size and located within ridges that conduct water effectively. Substitutes for sodium chloride have been sought, especially in groundwater areas. The effects of calcium chloride have been studied and it has been found that it has a more harmful effect on the built-up environment than sodium chloride. Although the effects of calcium chloride on the natural environment are of the same magnitude or slightly smaller than the effects of sodium chloride, the use of calcium chloride is not recommended. On the other hand, potassium formiate is a relatively suitable agent for antiskid treatment with respect to groundwater, although it can have a detrimental effect on steel and zinc plated steel, for example. It is important to notice that the means for achieving traffic safety and environmental objectives are to some extent contradictory from the perspective of antiskid treatment.

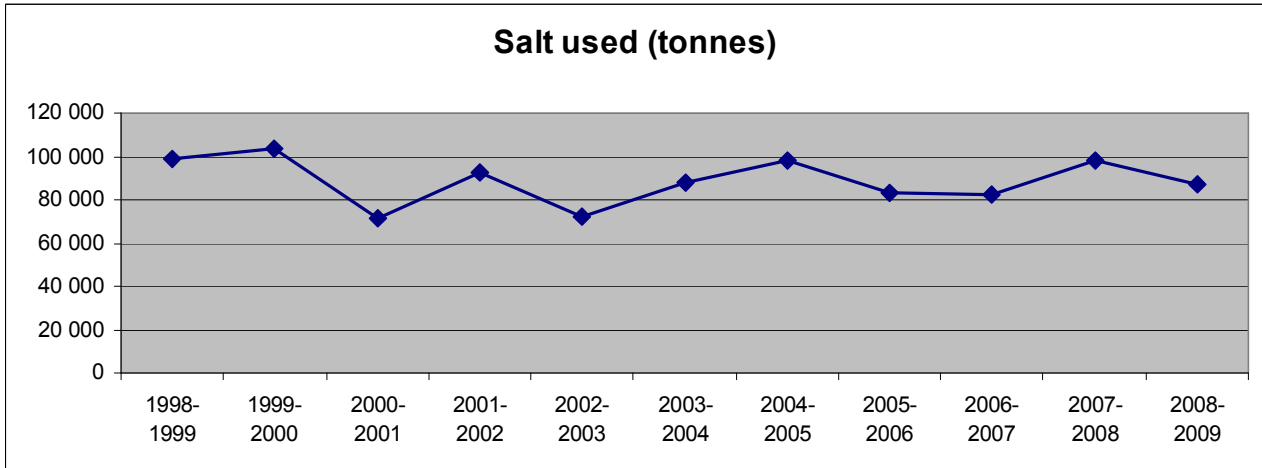


Figure 3 - Amounts of salt used during the winter season (does not include salt solutions)

### 3. KEY POLICIES

The following policies are followed in winter maintenance:

**Consistent level of service on traffic links.** Efforts are made to keep the level of service on the road network sufficiently consistent on traffic links from the perspective of the road user, regardless of administrative borders, contract areas or differences in traffic volumes. Maintenance borders are agreed for locations that are suitable for traffic.

**Consistent level of service around the clock.** Quality requirements during the night are raised to the same level as during the day. This ensures the safety and functionality of night-time transports, which are becoming more common all the time. At the same time, it is ensured that maintenance measures are carried out before the morning commuter and school trip traffic. The level of service is as balanced as possible at all times of the day and night.

**The level of service is adjusted and controlled on a local and temporal basis so that the needs of customers and the conditions of the roads are taken into consideration.** Consistent principles are followed throughout the country in the classification of the maintenance and the quality requirements of the road network. Nevertheless, common principles are applied according to regional and local needs and conditions.

**Winter maintenance provides the opportunity for safe travel during the winter. Antiskid treatment on busy roads will be improved in order to prevent accidents.** The objective is that the traffic safety risk during the winter is no higher than during other times of the year. Since winter naturally reduces the driving conditions of the road network, it is important for the purpose of traffic safety that the level of maintenance is as balanced and as predictable as possible. Antiskid treatment on the busiest roads will be improved in order to improve safety. The safety of winter traffic requires the coordination of the level of service and speed limits and that the road maintenance authority helps road users to prepare for exceptional and risky conditions through the provision of information on road conditions.

**On the busiest and most congested stretches of roads, winter weather will not cause significant additional delays.** The effectiveness of winter maintenance will be improved on the sections of roads most susceptible to congestion and disruptions. Antiskid treatment and snow ploughing will be carried out so that winter road conditions do not cause additional delays, vehicles are able to continue quickly after traffic lights and bus stops, and vehicles entering from slip roads can join traffic as smoothly as possible.

**The service level is set cost-effectively. The basic level of service will usually be maintained even on low-traffic sections of the road network.** With respect to efficiency and good effectiveness, the maintenance quality level will be set step-wise according to the use of the road. The aim is to achieve the best possible benefit-cost ratio on the road network. The basic level of service is guaranteed even on the low-traffic sections of the road network, which enables travel around the clock in normal conditions.

**There are clear operating procedures in case of exceptional weather conditions.** Travel can become significantly more difficult in exceptional weather conditions, which occurs a few times during the winter. Exceptional weather conditions will probably become more frequent as a result of climate change. Under exceptional conditions, the safety of traffic is ensured, as well as the reasonably smooth flowing of the most important traffic lanes.

**Environmental impacts are kept under control in groundwater areas. Replacements for sodium chloride are being sought in groundwater areas. Harm to air quality in urban areas will be reduced through cooperation.** The total amount of salt used is increasing somewhat due to the tightening of quality requirements resulting from the increase in traffic volumes and the changing conditions caused by climate change. Contractors must have the ability to use salt correctly and precisely so that the use of salt stays within controllable margins without compromising traffic safety. The risk to groundwater will be reduced in particular by reducing the use of salt locally in sensitive groundwater areas or by replacing sodium chloride with a biodegradable substance for antiskid treatment. The intention is to reduce the use of calcium chloride to reduce the impact on structures.

**The provision of information on road conditions will improve the opportunities for road users to have an impact on safe and smooth winter travel.** Travel in winter conditions requires adjusting the methods of driving and travelling and making preparations made according to the weather and conditions in all conditions. The provision of information on winter traffic supports the opportunities for road users to operate safely and responsibly.

**By improving cooperation between road maintenance authorities, it will be possible to avoid surprising differences in the quality of maintenance when crossing the border between the areas of two road maintenance authorities.** The borders between roads and streets should not be visible to road users. Cooperation on the winter maintenance of bicycle and pedestrian roads between the State and municipalities is intended to harmonise the level of maintenance of the lanes and the timing of maintenance measures.

**The operational preconditions of public transport will be supported through targeted winter maintenance.** The competitiveness of public transport will not be reduced during the winter due to winter maintenance; bus stops and connections between stops

will be taken care of sufficiently early. Special attention will be paid to stops that are important for school transport and the school transport routes themselves.

**The achievement of good quality is emphasised. Spot checks will be performed to monitor the achievement of quality requirements.** Road maintenance contracts are quality responsibility contracts in which the contractor has the main responsibility for achieving the ordered quality. The role of the contractor’s operating and quality plan will be enhanced. The orderer’s quality assurance operations must be sufficient to ensure that the actual quality delivered corresponds to the ordered quality.

#### 4. MAINTENANCE CLASSES AND THE LEVEL OF SERVICE

The road network is divided into maintenance classes in accordance with the following figure.

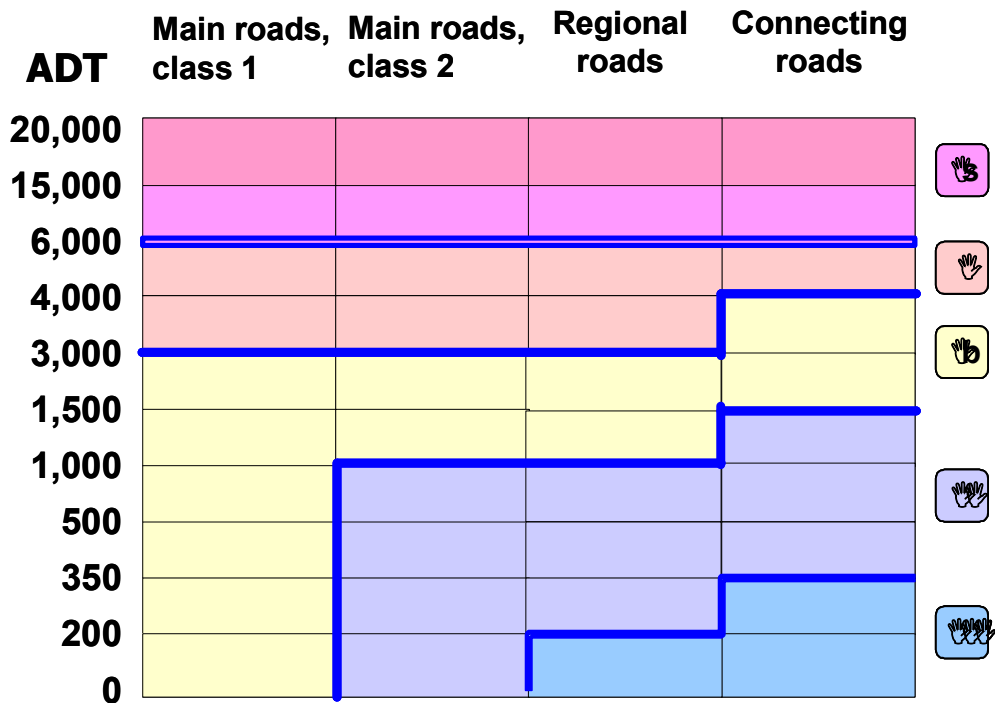


Figure 4 - Rough division of the road network into winter maintenance classes

The level of service in different maintenance classes is the following:

**Maintenance class Is:** The road is clear except during changeable weather situations. Slippery conditions are primarily prevented through proactive measures. Busy roads, with an ADT of over 15,000, are always clear except during exceptional conditions (Section 4.4) and long periods of sub-zero temperatures. On these roads, antiskid treatment is always carried out through proactive measures. Due to the high volume of traffic, on busy roads salt can be used outside the normal temperature limits (-6°C in the Is class).

**Maintenance class I:** The road is clear most of the time or it may have long, thin patches of compacted snow in between carriageways and roadways.

**Maintenance class Ib:** The road is maintained at a high quality, but mainly without salt. Depending on the volume of traffic and weather, the surface of the road is partly clear, partly covered with patches of compacted snow, or the road may be entirely covered with compacted snow. With the exception of problem situations, the road has good winter road conditions; antiskid measures are not carried out to the same level, but the road is sufficiently safe if road users take the prevailing conditions into consideration. Slippery conditions are prevented by using salt mainly during slippery conditions in the autumn and spring, or in similar "warm conditions", as well as in certain problem situations. During mid-winter, sanding in points and lines is used when necessary.

**Maintenance class Tib (urban area):** The roads are covered with a layer of compacted snow during mid-winter. The quality is similar to the quality on Ib roads, but the road may have thicker patches of compacted snow, which do not cause problems for traffic due to the low speed limits.

**Maintenance class II:** The road is mostly covered by a layer of compacted snow or, depending on the volume of traffic, the compacted snow may occur partly in patches. In normal conditions, the road is sufficiently treated for antiskid and smooth for a moderate level of traffic. Intersection areas, hills and curves are sanded so that driving is safe under normal conditions. The road is sanded completely during problem situations.

**Maintenance class III:** The roads are covered by a layer of compacted snow most of the time, and there may be ruts in some places. During periods of sub-zero temperatures, the driving conditions are mostly satisfactory, but may vary in some places. When the weather changes, and especially during freezing rain on layers of compacted snow, the road conditions may be problematic for several hours.

K1 and K2 are maintenance classes for bicycle and pedestrian lanes. Maintenance of K1 class lanes is carried out in the mornings before school and commuter traffic and they serve the needs of those using the lanes in the evenings and at weekends for leisure purposes. The level of maintenance allows bicycling, and the use of prams, wheelchairs and rollators. There is usually also a certain amount of school and commuter traffic on K2 class lanes. Following the maintenance measures, the level of quality is almost the same as on K1 lanes, except that the maintenance measures are carried out later than on K1 lanes.

The key quality requirements for winter maintenance classes are presented below:



Table 1 - Quality requirements for antiskid treatment  
 \*A C-trip friction meter based on deceleration is used in measuring friction







Winter maintenance class			 and  T			K1	K2
Friction requirement *	0.30	0.28	0.25	Roughened surface, problem locations are spot sanded	Roughened surface, problem locations are spot sanded	According to the needs of traffic	According to the needs of traffic
Must be considered	Road surface below -6°C 0.25	Road surface below -4°C 0.25	Spot sanding 0.25, line treatment 0.22			after 10 p.m., by 6 a.m.	after 10 p.m., by 7 a.m.
Time to carry out measure when falls below	2h, on busy roads 0h	2h	salt 3h sand 4h	Line sanding of icy compacted snow 6h	Line sanding of icy compacted snow 8h	2h	3h

Table 2 - Quality requirements of snow removal
















Winter maintenance class			 and  T			K1	K2
Maximum depth of snow during snowfall	4cm	4cm	4cm	8cm	10cm	3cm	4cm
Time to clear after the end of snowfall	2.5h (slush 2h)	3h (slush 2.5 h)	3h	4h	6h	3h	4h
<ul style="list-style-type: none"> <li>▪ Ploughing must be started at the latest when half of the maximum depth has accumulated on the ground (so-called 'threshold')</li> <li>▪ Maximum snow depth must not be exceeded during snowfall and after that while the measure is being carried out.</li> <li>▪ Only half of the snow can be slush.</li> <li>▪ The time to carry out the measure starts when the snowfall ends and ends when the traffic lanes have been cleared.</li> <li>▪ If the snowfall ends after 10 p.m., K1 class roads will be ploughed by 6 a.m. and K2 class roads by 7 a.m.</li> </ul>							

Table 3 - Quality requirements of the smoothing of the road surface

Winter maintenance class			 and  T 			K1	K2
Greatest permitted irregularity	-	1 cm	1.5 cm (T  2 cm)	2 cm	2 cm	2 cm	2 cm
<ul style="list-style-type: none"> <li>▪ During cold periods when salting is not possible the smoothness requirement of maintenance class  is 1 cm</li> <li>▪ Thin ruts and other irregularities in the compacted snow must not significantly impair driving</li> </ul>							

## 5. POLICIES DURING EXCEPTIONAL WEATHER CONDITIONS

On average, exceptional weather conditions occur a few times a year. A snowstorm is considered to be exceptional when at least 10 cm of snow falls continuously during a four hour period. Situations resulting in snowdrifts on roads, which have been specified separately, are also considered to be exceptional snowstorms.

Under exceptional conditions, the safety of traffic is ensured, as well as the reasonably smooth flow of the most important traffic lanes, especially for heavy traffic. The key factors are careful advance planning, acting as fast as possible, the full use of the capacity of the main contractor and subcontractors, and increasing the salt quota when necessary. It is ensured that the contractor is able to carry out its work under exceptional conditions. Good maintenance during exceptional weather conditions does not produce additional sanctions for the contractor if the operations are in accordance with the operational and quality plan. The contractor must indicate extra equipment in its operating and quality plan for the maintenance of the busiest roads.

Careful advance planning encompasses separate specifications of quality requirements for exceptional conditions, proactive quality assurance measures, as well as the sufficiency, organisational readiness and competence of the contractor's resources. The orderer prioritises the road network from the perspective of exceptional weather conditions in the road district's maintenance and service plan, for example.

Communication between contractors and different contract areas is also important, especially for the implementation of maintenance measures on main roads. The contractor's internal quality assurance must cover the abovementioned matters, including for the operations of subcontractors. Agreements on how to organise operations if the situation becomes exceptional (resource aid, helping the authorities) must be prepared in advance. As a part of its operating and quality plan, the contractor must present a contingency plan for operations during exceptional weather conditions, so as to ensure reasonable traffic conditions in the section of the road network affected by the problems.

Quality must be returned to normal as quickly as possible in exceptional weather conditions, with the contractor using all of the equipment specified in its operating and quality plan. Even in exceptional weather conditions that last a long time (when the rules on rest periods enter into force), quality must be returned to normal within half a day on roads with maintenance class Is, I and Ib (in the morning before commuter traffic) and on other roads within one day.

## 6. THE QUALITY ASSURANCE

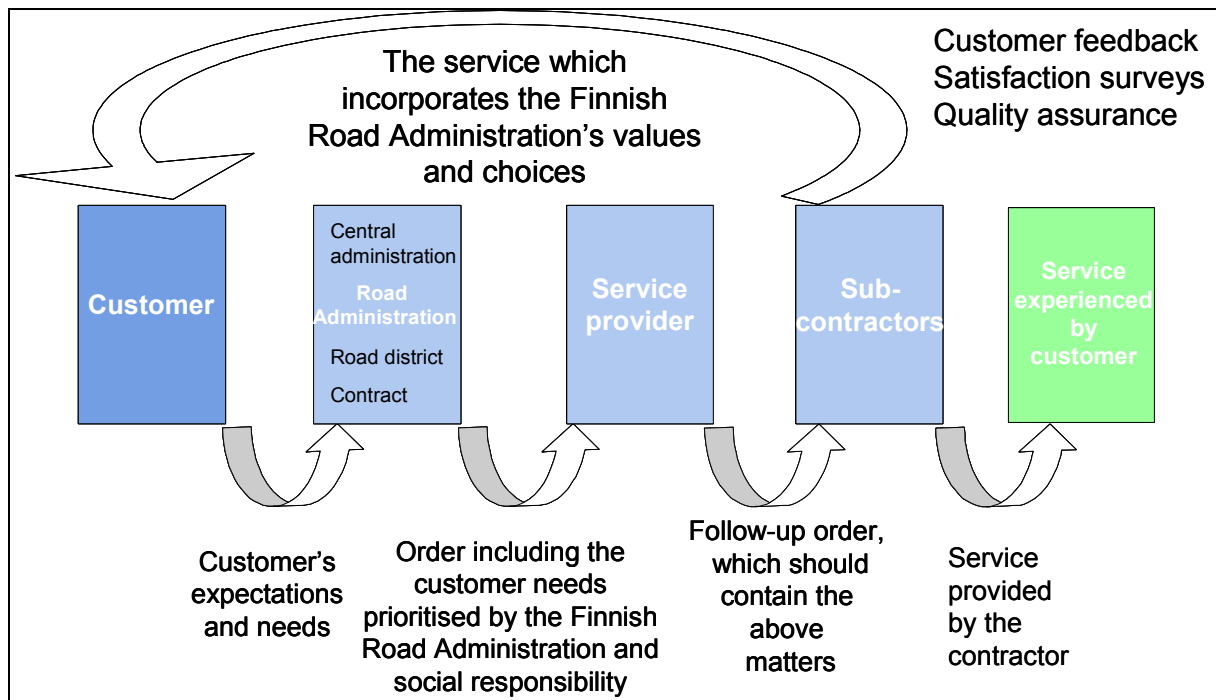


Figure 5 – The entire service chain must function well so that the level of service meets expectations

When drawing up winter maintenance policies and considering the level of service to be offered to residents, it is important to consider the whole service chain through which road users receive the services intended for them. Ensuring a uniform level of service even when carrying out work in-house has been an extremely challenging task. This is even more difficult in the current situation where all maintenance work is ordered from private contractors who, for their part, usually use sub-contractors for actually carrying out the work. The sub-contractor at the end of the chain is unlikely to have ever even heard of the policies and service-level expectations prepared by the Finnish Road Administration.

The level of service set out in the policies should be described in the documents for the invitation to tender as unambiguous quality requirements and contract-specific specifications that the contractor must, under threat of sanctions, comply with and which are relatively easy to measure or otherwise supervise.

Customer satisfaction bonuses have been piloted instead of strict requirements, but the impact of the customer satisfaction bonus has not so far matched expectations. They have not directed the contractors' operations in the hoped for manner. Customer satisfaction measured through a separate questionnaire acts as the indicator used in Finland for the customer satisfaction bonus. However, in winter the severity of the conditions has more of an impact on customer satisfaction than what the contractor can usually do through maintenance measures. During severe winters, even a large number of maintenance measures do not achieve a level of service that satisfies customers. Furthermore, customers do not necessarily understand that the road they live by is not classified as the highest priority and that it may take a long time for the snowplough to come according to the service level ordered for their road.

Abandoning the use of the current type of bonus has been discussed. At least the way of assessing the bonus should be changed to better respond to the measures that contractors undertake. The alternative assessment methods presented have not so far satisfied all the parties.

Since the bonus model used has not worked in the desired way, attention has been paid to increasing the effectiveness of supervision. The Finnish Road Administration's own organisation has been cut to such an extent that it no longer has sufficient time to perform spot-check inspections, which is why it has started to use independent inspection consultants. The use of inspection consultants has the advantage that they report their findings systematically, unlike the Finnish Road Administration's own inspectors, whose findings are reported in a rather more sporadic manner through emails sent to contractors.

Winter maintenance operations are carried out in real time according to the weather and conditions, and the service provided for customers is available before the Finnish Road Administration has been able to approve it, which is not the case in road projects, for example. Contractors should assume responsibility for the quality of their work pursuant to the agreement, although in tough price competition the temptation to avoid work that the Finnish Road Administration does not immediately notice is great. The risk of getting caught for work not carried out by contractors should be increased. Therefore, the Finnish Road Administration will use all means necessary to control the work carried out by contractors, such as by increasing audits. It is only appropriate with respect to all parties that the quality requirements for winter maintenance have been defined as clearly as possible and that they are adhered to so that the resulting quality corresponds to what has been ordered.