

**Economic and Social Council**Distr.: General
13 February 2019

Original: English

Economic Commission for Europe**Inland Transport Committee****Working Party on Transport Trends and Economics****Group of Experts on Climate Change Impacts and
Adaptation for Transport Networks and Nodes****Seventeenth session**

Geneva, 24 and 25 April 2019

Item 2 of the provisional agenda

Climate Change and Transport Networks and Nodes:**Presentations of initiatives at national and international levels****New Guidelines for Winter Maintenance of Roads in
Finland*****Submitted by the Government of Finland****I. Introduction**

1. This document provides a case study on economic impact from climate change on maintenance of road network in Finland. The Group of Experts requested at the sixteenth session that this case study is tabled as an official document at the seventeenth session.

II. New Guidelines for Winter Maintenance of Roads in Finland

2. The winter maintenance guidelines have been renewed based on climate change and customer feedback. The Minister of Transport and Communications initiated the development programme of winter management in February 2018. The previous guidelines were from 2008. The new guidelines will be implemented in two phases: (a) updating the maintenance classification of 11,000 km of state roads on 1st January 2019, and (b) updating quality requirements in contracts by tendering contracts from 2019 to 2024 using a

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new performance-based contract model and target price, which will distribute the cost risk due to, e.g., climate change between the infra manager and contractors. Awarding criteria in the bidding process have also been renewed; contractors will submit performance and quality promises, such as ability to react, response time and proactive actions. The new guidelines and quality requirements have been developed with the goal of safe and smooth traffic. The new guidelines concentrate on the demands of heavy traffic and commuting, the effects of climate change and targeted maintenance.

3. There is a total of 78,000 km of state roads in Finland. The roads are classified into main roads and minor roads, which are further divided into maintenance classes, mostly according to traffic volumes and the volume of heavy traffic. Maintenance is entirely contracted out, and there are 79 maintenance area contracts, mostly for 5-year periods. Maintenance is financed through the government budget. The cost of winter maintenance is ca 55 per cent of the total maintenance costs. The Finnish Transport Infrastructure Agency defines the national policy, quality standards and guidelines of the procurement process.

4. In the new quality requirements, the action times for friction and snow removal (ploughing) are shorter, and the ploughing threshold is lower for low and medium traffic roads. There is a new requirement for extra equipment for combating slipperiness in extreme weather conditions. The use of alternative de-icing chemicals, such as potassium formate, is mandatory on areas where chloride has decreased the quality of the ground water.

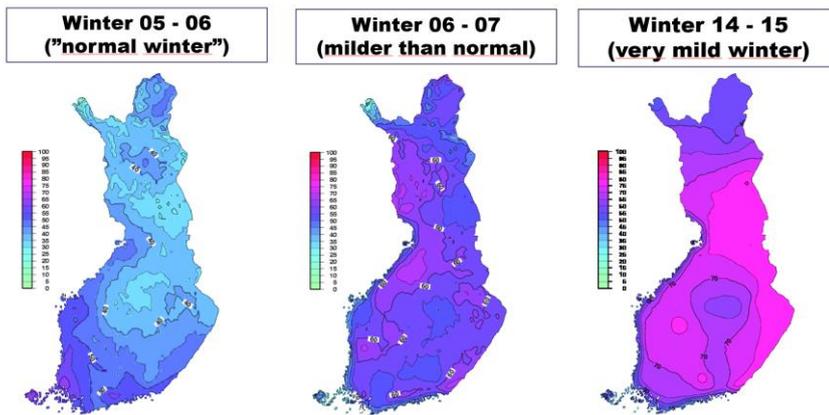
III. Weather conditions

5. Due to climate change, warmer weather conditions occur not only in early and late wintertime but also in the middle of winter, which is the reason for similar maintenance requirements in mid-winter. Figure 1 shows the number of times when the temperature crossed 0°C degrees in three different winter periods in Finland. The winter period 2005–2006 was a "normal" winter, winter 2006–2007 was warmer than normal and winter 2014–2015 was even warmer. Warmer winters have increased the need for de-icing the roads, especially in inland Finland; the typical "coastal weather conditions" have spread to inner parts of the country.

6. The mean winter temperature has been 1 to 4 degrees higher than the long-term average in Finland. The freeze-thaw cycles occur more often than before. It rains more often in northern Finland in wintertime, and heavy snowing occurs more often. However, the amount of extreme weather events has not clearly increased. The road drainage problems that have usually occurred in summer months now occur in wintertime also. Pavements are more often wet, and de-icing chemicals are needed more.

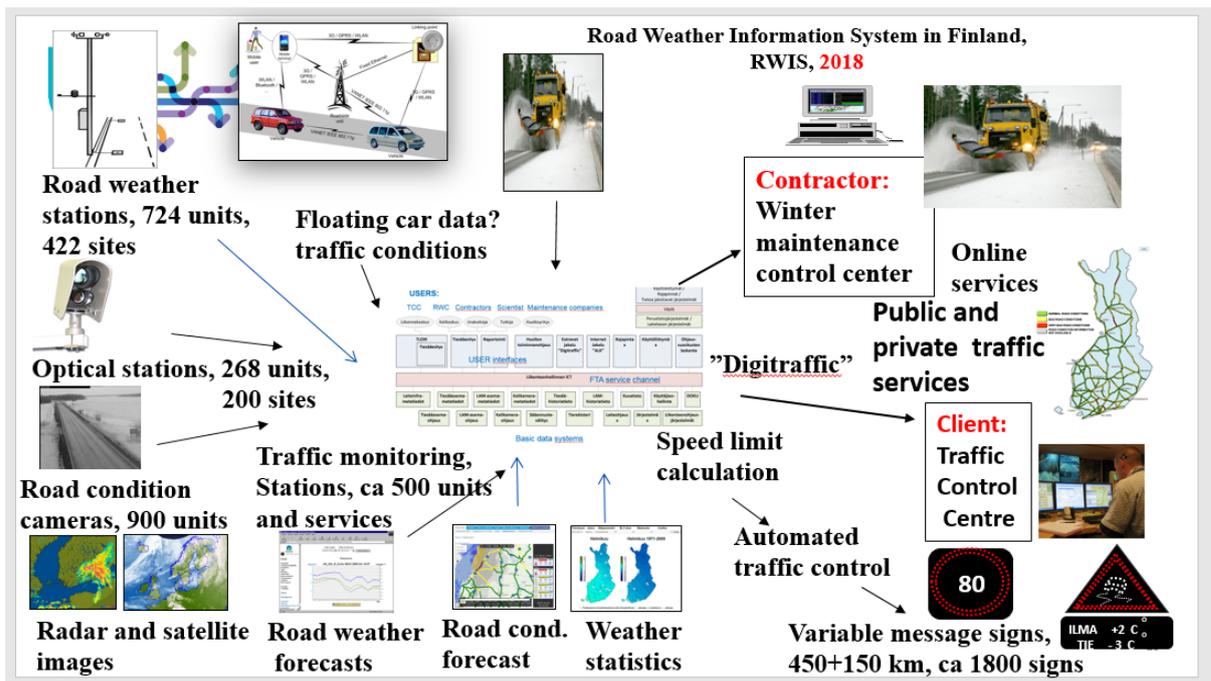
Figure 1

The number of times when the temperature crossed 0°C degrees in three different winter periods in Finland



7. The changes in weather types have been occurring faster than before, which has increased the importance of good weather forecasts and proactive information. Road weather is monitored with road weather stations, road condition cameras and radar and satellite images. This information, together with weather forecasts and statistics, is combined with the road weather information system, which is used by contractors, traffic control centres and public and private traffic services (Figure II). The system also calculates the speed limits for variable message signs (ca 1800 signs).

Figure II
Road weather information system in Finland



IV. Effects

8. The new guidelines consolidate the quality requirements of the winter maintenance of main roads, which enables clear quality assurance and maintenance methods. The new guidelines more accurately take into account the needs of heavy traffic. In urban areas, requirements for busy cycle paths have also been raised.

9. Business and transport will benefit from the changes, customer satisfaction is expected to be higher, the morning traffic on minor roads will benefit from the changes, and the number of injury accidents and seriously injured is predicted to be lower. The lifecycle of fragile pavements will be longer due to using mostly sand instead of salt to meet the friction requirements.

10. It is predicted that salting will increase by 20–25 per cent and sanding by 25–30 per cent. In classified ground water areas, salting will be minimised and formates utilised to meet safety regulations, and new ground water protections will be built as part of the new road projects.

V. Costs

11. The total annual cost of winter road maintenance in Finland has been, on average, €100 million. After adopting the new winter maintenance guidelines by 2023, the costs are predicted to be €120 million/year. Additional financing of €15 million was budgeted for winter maintenance of roads for 2019.

12. In the twenty-first century, the expenses of gravel road maintenance have increased by at least 10 per cent, due to climate change/warmer winters. Shortened ground frost periods have resulted in the need of more frequent pavement repairs, and the potholes that occur all year round and those have become more difficult to repair in winter. The cost of asphalt repairs has increased by 50 per cent over the last ten years.
