

EVALUATION OF THE ROAD WEATHER SERVICE

Anna Schirokoff

Research Scientist, VTT Technical Research Centre of Finland
P.O. Box 1800, Fin-02044 VTT, Finland
Tel. +358-9-4564991, Fax +358-9-464850, E-mail anna.schirokoff@vtt.fi

Anu Tuominen

Research Scientist, VTT Technical Research Centre of Finland
P.O. Box 1800, Fin-02044 VTT, Finland
Tel. +358-9-4564976, Fax +358-9-464850, E-mail anu.tuominen@vtt.fi

ABSTRACT

The aim of the road weather service is to help drivers to prepare for delays and difficult driving conditions caused by the weather, specifically on days when conditions are most dangerous. In the winter season 2002-2003 the service was produced as a result of co-operation of three organisations. The studied issues were: a) How was the weather on the most accident-prone days and what kind of weather warnings had been given for those days? b) Did the forecasts given by different organisations differ? Were there regional differences inside organisations? c) How well did the weather and road condition forecasting process work?

INTRODUCTION

The risks drivers face in adverse weather and road conditions are many times those encountered on a bare road surface. Malmivuo and Peltola (1997) have estimated that the risk between different road conditions in Finland can be classified as follows: bare 1, snow 9, slush 12 and ice 17. The large variance in risk figures shows that drivers do not adapt their behaviour well enough in different conditions.

According to road accident investigation teams in Finland, 16% of all fatal accidents in January, February, March and December 1996 occurred when the road surface was bare and dry. The corresponding figures were 16% for wet conditions and 67% for snowy, slushy and icy conditions (Liikennevakuutuskeskus 1997). The share of traffic kilometreage in different road conditions in winter 1992-1993 was 44% in dry conditions, 25% wet, 14% wet with salting, 6% snowy, and 11% frost and icy (Saastamoinen 1994). These figures represent different years and as such are not fully comparable, but it is evident that the share of fatal accidents in poor road conditions is much higher than the share of kilometreage in the same conditions.

Despite effective winter road maintenance hazardous road conditions cannot be avoided entirely. Since winter 1997-1998 the road users in Finland have been given information on the forecasted driving conditions on the main roads. The aim of the road weather service has been to help drivers to prepare for delays and difficult driving conditions caused by the weather, specifically on days when conditions are most dangerous. The forecast is based on current weather and road conditions, maintenance, and weather forecasts. The validity of the forecasts

is 24 hours and it is given at least four times a day. Forecasts are regional based on 19 provinces. The forecasts are given on national TV and radio channels as part of normal weather forecasts, but are also provided on the Internet (Figure 1). The service was developed jointly by the Finnish Road Administration (Finnra), the Finnish Meteorological Institute (FMI), the Central Organisation for Traffic Safety in Finland, the Finnish Motor Insurers' Centre, and the Finnish Broadcasting Company.

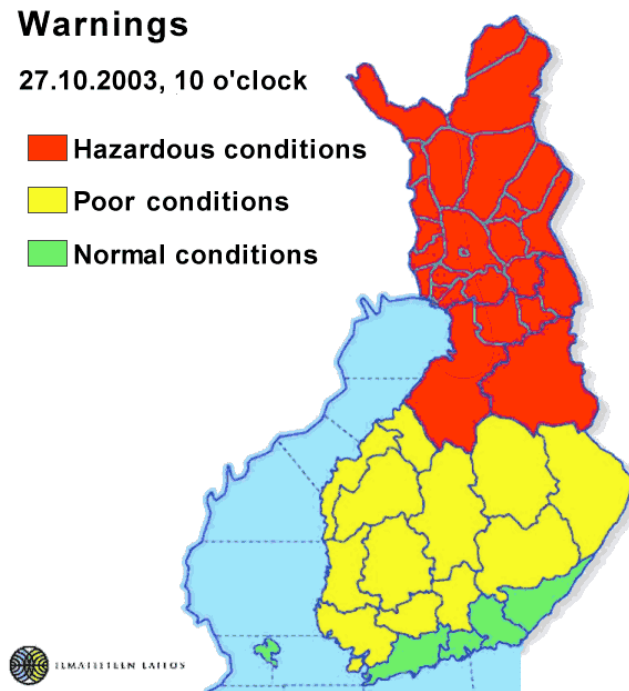


Figure 1. An example of a warning map given on TV and on the Internet.

The service sets three levels for conditions on roads: normal, poor, and hazardous. Normal road conditions in the southern parts of Finland mean that the main roads are relatively bare; further north road surfaces are often worn into grooves by the passage of vehicles. In the worst case normal road conditions indicate light snowfall that is not expected to continue. Road weather is poor when there is heavy snowfall or snowfall is expected to continue for a long time, visibility is clearly reduced because of the snow, or changing temperatures cause slipperiness. Conditions are hazardous when freezing rain causes slipperiness that cannot be prevented through maintenance, or when the snowfall is so heavy roads cannot be adequately ploughed. The criterion is set so that 60-70% of the time the classification is expected to be normal weather, 20-30% poor, and approximately 5% hazardous. The proportions are preliminary and not to be interpreted as real values.

During the years the service producing process has varied. Validity of the forecasts has varied from 12 to 24 hours, and national weather forecasts have been received from different companies. However, the biggest change was the privatisation of the maintenance operations of the Finnra. In the winter season 2002-2003 the service was produced as a result of co-operation among three levels of organisations. It was based on 6-hour forecasts that private maintenance contractors gave four times a day based on the weather forecasts and scheduled maintenance on the main roads of their operating areas. Forecasts were collected at the traffic management centres (TMC). TMC operators combined the forecasts for each province and if necessary, changed them, and gave their 6-hour forecast to FMI, where the official national road weather forecast was compiled. See Figure 2. As a principle in the process was, that one

organisation never forecasted a worse road weather class than the previous organisation without negotiating.

Based on the agreements, the maintenance contractors were supposed to give their forecasts four times a day, latest at the time spots given in Figure 2. However, if the road conditions suddenly and unpredictably changed contractors were obligated to give an extra forecast. Additionally, if the road and weather conditions were forecasted to be normal for several days contractors were allowed to give daily only one forecast.

TV, radio, text-tv, internet				
↑				
Meteorological institute, 24h forecast	5:00	9:30	15:00	18:30
↑	↑	↑	↑	↑
TMC, 6h forecast	4:30	8:50	14:20	17:30
↑	↑	↑	↑	↑
Maintenance contractor, 6h forecast	3:30	8:15	13:30	16:45

Figure 2. The service production process.

In the winter season 2002-2003 one company maintained most of the public roads. Its work was co-ordinated and the forecasts were given from its four weather management centres. Other companies with smaller maintenance areas in different parts of the country bought their operating and forecast service from a private weather management centre. Finnra had 8 regional TMCs collecting and analysing the maintenance forecasts. Two TMCs had a 24-hour service. Other TMCs were closed during the weekends and night-hours. The opening hours varied some between the centres.

The service has been evaluated every year since it was started. The aim of the evaluations has been to annually improve the quality of the service. The earlier evaluations have been conducted with four methods: interviews of car drivers, interviews of experts, analysis of the warnings and actual road conditions of the most dangerous days, and comparisons of the given forecasts with the actual conditions. For each winter a various set of methods has been used.

The service has been well recognised: in the first winter 87% of the interviewed drivers knew it (Nygård and Rämä 1999), two years later the share was 90% (Anttila et. al. 2001). Most of the drivers (77%) found the service useful compared with regular weather forecasts, and 77% of the drivers said that they had used the service's information almost daily. However, in the first years the content and the used road weather categories in detail were not known as well: in the first winter only 54% and in the third winter 33% of the drivers described the categories correctly. Interviews have not been conducted since that so the current awareness is not known. Interviews have also indicated that getting information on the following day's weather was important and that the service had a considerable effect on drivers' driving behaviour (Anttila et. al. 2001).

The aim of this study was to evaluate the road weather service in the winter season 2002-2003. The studied issues were: a) How was the weather on the most risky days and what kind of weather warnings had been given for those days? b) Did the forecasts given by different

organisations differ? Where there regionally differences inside organisations? c) How well did the new weather and road condition forecasting process work?

METHOD

In the study the following databases were used: 1) FMI database which contained weather and road condition forecast classes given for each province four times a day, 2) a database that contained road weather forecast classes given by both maintenance operators and TMC operators, 3) a database including the traffic accidents reported to traffic insurance companies, 4) Finnra database including police reported injury accidents.

The days were divided into three categories depending on the daily number of accidents. The day was classified as normal if the number of accidents was below the average + 20%. The accident number was high when more accidents than 80% above the average had been reported. Such days were also called peak days. Between these two categories, the accident number was categorised as elevated.

The successfulness of the service was estimated by counting the share of time of the forecasted road weather classes during the whole winter and by studying the weather and the road weather forecasts of the days when the accident numbers had been high. By these studies the validity of the service was estimated.

The successfulness of the service process was estimated by comparing the forecasts given for provinces by different organisations. The forecasting times of both the maintenance operators and TMC operators varied daily and by provinces. Hence, the comparison was done automatically so that the shares of time of equivalent and different coincident forecasts were counted. The final road weather forecasts were compared with the last given TMC forecasts. The reasons for the differences in the forecasts were clarified by interviews of the persons involved the process.

RESULTS

During the winter season 2002-2003 the service classified the road weather as normal 70% of the time, as poor 26% of the time, and hazardous 2% of the time. Monthly differences were high: share of the normal being 50-86%, share of the poor being 11-44% and the share of the hazardous weather being 0-5%. The greatest shares of poor and hazardous weather and road conditions occurred in January (Table 1). Differences existed also between provinces.

Table 1. Timely shares of the forecasts by months.

Forecasted road weather	Share of the time (%)						
	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Normal	64	65	77	50	69	80	86
Poor	30	29	20	44	28	17	11
Hazardous	3	4	2	5	0	0	1
missing	3	2	0	1	3	3	1

During the winter (Oct-Mar) 29 025 accidents were reported. 63 % of the accidents happened as the normal road weather forecast was valid, 32% as the poor was valid, and 4% as the hazardous was valid. According to the used accident criteria, 9 days were classified as peak days. For all of the peak days, except one (December 23 with high traffic volumes), forecasts of the poor or hazardous road weather had been given on the previous night, however the bad weather forecasts could have been given for larger areas.

Forecasts of the maintenance operators and TMCs were equivalent 83-96% of the time depending on the province. The road weather class suggested by a TMC was worse 3-13% of the time and better 2-10% of the time. Some regional TMCs had changed the maintenance operators' forecasts more often than the 24h-TMCs which worked for them during nights and weekends. Forecasts for the northern Finland had been changed more by the 24h-TMC, that is located in the southern Finland, than by the regional TMCs.

DISCUSSION

The results showed that the maintenance contractors and the operators had most of the time agreed on the forecasts. According to the data, forecasts had been changed also against the principles, i.e. TMC had changed the forecast from poor to normal. However, according to the interviews most of these cases can be explained. The better forecast was usually given as a result of negotiations but after the agreed classification maintenance operators seldom made changes into the original database.

In principle, the operators classified similar road and weather conditions into same groups. However, some problems existed when classifying hazardous conditions. It would be advantageous to all operators to assemble for a session where the policies and principles would be discussed. But problems exist also as the drivers, as well as the operators, consider normal road condition in the northern parts of the country different to those in the southern parts.

The current service process is complicated and according to the interviews, also partly unknown for the operators. To be able to increase the quality of the service, the whole process, including all the tools and databases, should be clarified to the operators in every organisation.

In winter 2002-2003 the accident peak days were well foreseen and poor or hazardous road weather forecasts were given on previous days at least for some provinces. However, more than a half (63%) of the peak day accidents happened as the poor road weather forecasts were valid.

The study was conducted to better the quality of the service. Previous studies had shown that the service was well accepted. The service was well known, and the road users regarded that the information provided affected their driving behaviour in several ways. It was assumed that the service affected drivers on the every decision making level (strategic, tactic and operational) - strategic being the most important for the traffic safety. Effects of the information services have seldom been able to show in studies. It is often impossible to distinguish the effects of an information service to driver behaviour from the effects of other incidents as weather and road condition.

Neither this study brought any new information on the effectiveness of the service, in the other words whether the service affected the number of accidents in the accident-prone days. It was neither studied whether the forecasts had affected traffic volumes, which by itself affects accident numbers. But it can be assumed that even though the service would be perfect, the peak days would probably not disappear: everybody does not get the information, everybody is not able to change driving behaviour in the right, and some do not care.

Further research is needed on the effects of the road weather service. In the future, methods for the evaluation of this traveller information service should be developed. One approach might be the comparison of the accident numbers during the poor weather periods with the road weather forecasts given prior to these periods. In this kind of research, however, the vehicle mileage in the studied areas should be taken into account.

Today only the beginning of a poor or hazardous road weather period is forecasted. From a road user's point of view, also information on the beginning of the normal road weather could be useful when making pre-trip plans. Some trips might probably be changed to be done first, as the road weather would have changed.

Earlier studies showed that drivers did not know the road weather categories in detail. It can be also assumed that they do not know either know what these different categories really mean to their driving safety. Drivers should probably be informed more what poor and hazardous conditions mean in practice - including the knowledge on accident risks on different road surfaces and the stopping distances on different speeds and road surfaces.

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