

ROAD WEATHER INFORMATION SERVICE IN FINLAND

Mr. Magnus Nygard

Finnish Road Administration / Traffic Services
P.O.Box 33, FIN-00521 Helsinki, Finland
Tel. +358 20 444 2423, fax +358 20 444 2418, Magnus.Nygaard@tiehallinto.fi

Mr. Jorma Helin

Finnish Road Administration / Traffic Services
P.O.Box 33, FIN-00521 Helsinki, Finland
Tel. +358 20 444 2520, fax +358 20 444 2418, Jorma.Helin@tiehallinto.fi

Abstract

The Road Weather Information Service is a Traffic Information Service in Finland that started in winter 1997–1998. The service provides drivers with forecasts on road and weather conditions on winter between October and March. The forecasts are based on road conditions and weather. Also the maintenance actions are taken into account in deciding the classification. The information is presented in systemised way on national television and radio in connection of weather forecasts.

The primary aim of the Road Weather Information Service is to provide drivers continual updates on road conditions for improving the safety. With the help of the service the drivers can also estimate the conditions in advance or time at journey and then for example reserve more time for their journey or even change their mode of travel.

The service has been evaluated after each winter to see the effects of the service. The main result was that the service was well recognised around 90% of the interviewees recognised the service. The road users estimated that the effect of the Road Weather service on their own behaviour was notable. For example, after the first winter 63% of interviewees said that road weather had a strong or very strong influence on their time reserved for the journey. Furthermore, 71% of interviewees said that the information had influence on their driving.

Introduction

Traffic information relating to weather and road and traffic conditions is an area under constant development by the Finnish Road Administration (Finnra). Despite the continuous improvement of winter road maintenance hazardous road conditions in winter cannot be avoided entirely, and drivers must occasionally cope with bad conditions. The risks drivers face in adverse weather conditions in Finland 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.

Roine (1993) concluded in a study that drivers did adapt their behaviour according to road conditions when driving in a curve, so that the average speed was lower in slippery conditions. However, this difference was not enough to compensate for the higher risk in slippery conditions. Drivers' ability to estimate the slipperiness of the road correctly has been found to be poor (Heinijoki, 1994). Also, in another Finnish study (Estlander, 1997) it was concluded that the drivers do not recognise the slipperiness

winter road conditions or they do not experience the slipperiness as a hazard. The mean speeds in slippery conditions were similar as the speeds when the road surface was wet with salting.

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.

Drivers continue to stress the importance of information on weather and road conditions. In a study of the information needs of Finnish drivers, information on weather and road conditions was considered more important than that concerning road works, fluency of traffic, or that about routes, travel times and schedules (Penttinen et al., 1997). The effects of information on weather and road conditions was also estimated to have the greatest impact on drivers' behaviour such as driving style, time reserved for travel, and choice of time of departure. Effects were even observed on travel mode and the decision to start the trip at all. Women and people with lower annual kilometreage appreciated information on dangerous conditions more than did other drivers.

Road Weather Information Service

The Road Weather Information Service is a Traffic Information Service in Finland that started in winter 1997–1998. The service provides drivers with forecasts on road and weather conditions on winter between October and March. The service has been developed jointly by the Finnish National Road Administration, the Finnish Meteorological Institute, the Central Organisation for Traffic Safety in Finland, the Finnish Motor Insurers' Centre, and the Finnish Broadcasting Company. The service has been constantly under development after the beginning. Service is based on Finnra's information on road conditions and knowledge of maintenance operations, combined with weather information from the Meteorological Institute.

The Road Weather Information Service was developed for television and radio broadcasting. One of the aims was to provide drivers with continual updates on road conditions. Presentation of the information was systematised to provide consistent information through the various media. Another aim was to reduce the number of warnings of poor road conditions.

Road Weather Information Service forecasts were prepared by Finnra's road weather centres in co-operation with regional offices of the Meteorological Institute. The road weather centres made an estimate of road conditions for the next 24 hours, based on weather forecasts and planned road maintenance operations. Information about the latter was obtained from regional Finnra offices. The estimates followed agreed criteria for the classification of road weather, in which geographical differences between regions (mostly North-South) were taken into account. The estimates were sent to the central office of the Meteorological Institute, where the official national road weather forecast was compiled. The road weather forecast was then presented, together with the national weather forecast, on television and national radio channel. The information was also provided to other media if they were interested. The up to date information is also available on Finnra's web site: www.tiehallinto.fi/alk/english/ .

The Road Weather Information Service sets three levels for conditions on main roads: "normal", "poor", and "hazardous". Road weather forecasts were added to the national weather forecasts starting on 1

October and are compiled three times a day: early morning, forenoon and afternoon. The information is presented for each of the 19 provinces, thus it is an overall description of road conditions.

“Normal road conditions” indicates light snowfall that is not expected to continue. The "normal conditions" are slightly different in different areas of the country. In "normal" conditions in southern parts of Finland the main roads are relatively bare; further north road surfaces can be often worn into grooves by the passage of vehicles. 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 "normal conditions" are not actively presented in forecast, only the "poor" and "hazardous" conditions are. Figure 1 presents an example how the Road Weather Information is presented in television.

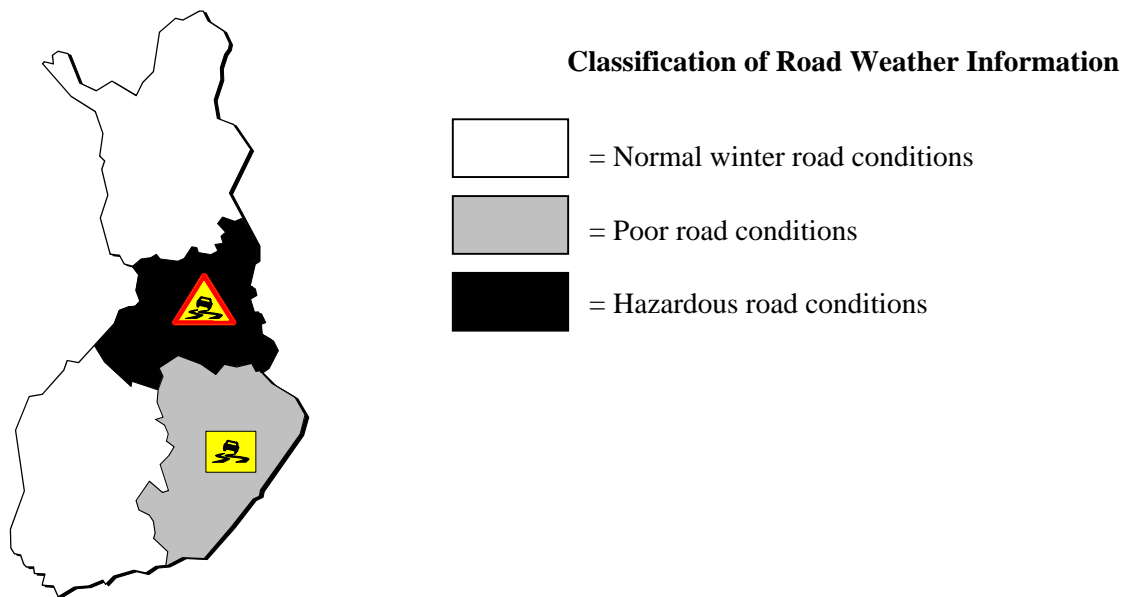


Figure 1. Example on Road Weather Presentation in Television

The primary aim of the Road Weather Information is to provide drivers with continual updates on road conditions for improving the safety. With the help of the service the drivers can also estimate the conditions in advance and thus adapt their travel behaviour. The service also aimed at reducing the number of warnings of poor road conditions. One specific aim was to have distinct warnings for days with the most dangerous conditions, which typically occur on 5 to 10 days every winter.

Evaluation of the Road Weather Information Service

The aim of the study was to evaluate how well the aims of the Road Weather service have been met. The studied issues were: how well do drivers know the service and their opinion of it, correctness of Road Weather Information, difficulties and problems producing the service and the experts' opinions on the service.

The evaluation was conducted with various methods, including interviews of car drivers, evaluation of the forecasts on log sheets at the traffic management centres, comparison with the numbers of accidents and forecasted Road Weather classification and also by interviewing the personnel working with Road Weather and other experts on the area. These different methods were used to tackle various issues of

interest. All the methods were used for studying the effects on winter 1997–1998, on winter 1998–1999 no drivers' interviews were made and on winter 1999–2000 the log sheets for Road Weather classification were not used due to technical problems.

Interviews of car drivers

The aim of the car driver interviews was to study whether the drivers recognised of the Road Weather service, and if so, how well they knew its contents. The aim was also to estimate how the information affects their behaviour, and how important the service is. Suggestions for further improvement were also collected. The subjects were interviewed by phone.

The service has been evaluated after each winter to see the effects of the service. The main result was that the service was well recognised after the first winter: 87% (n = 1005) of the interviewees recognised the service. This same figure was confirmed in another interview (Rajalin and Koivukoski, 1998). After three winters of the service, 90% (n = 1304) of interviewees recognised the service. Of the subjects who recognised the information service without prompting, 54% knew that the service provides information on poor/hazardous road conditions after the winter 1997–1998. After winter 1999-2000 this had dropped to 33%, which indicates that the public should be better informed about the contents of the Road Weather Information.

The road users estimated that the effect of the Road Weather service on their own behaviour was notable (Figure 2). For example, after the first winter 63% of interviewees said that road weather had a strong or very strong influence on their time reserved for the journey. Furthermore, 71% of interviewees said that the information had influence on their driving. Between 20% and 70% of subjects answered that the service had a “marked or very marked” effect on their behaviour on all the presented issues.

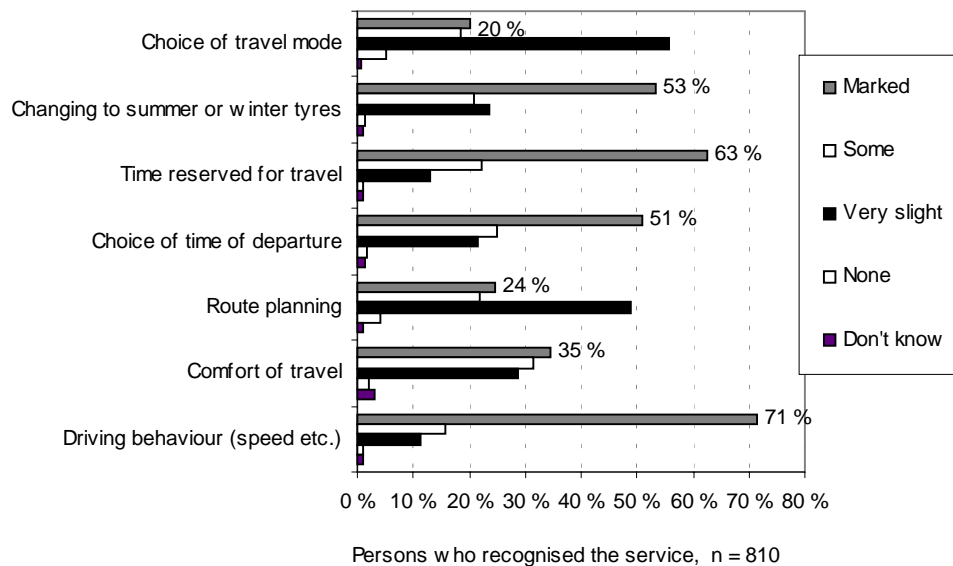


Figure 2. How great an effect has the Road Weather Information service had on your driving behaviour?

Women answered more often than men that the Road Weather Information service had an effect on their behaviour. This trend was observed in all the answers to this part of the questionnaire. Middle-aged subjects (30 - 64 years) answered more often than others that the information had no influence on their choice of travel mode. Subjects driving over 30 000 km per year answered that the Road Weather Information service had little effect on their behaviour.

When asked whether they had benefited from the new road traffic information compared with the regular national weather forecast, around 75% of drivers responded that they had. Professional drivers felt more often than others that they had benefited from the service

The estimated effects of the Road Weather Information service were often greater than in a previous study that covered different traffic information types (Penttinen et al., 1997). For example, in this study the service was said to have a strong or very marked effect on the time reserved for travel (63%) and on the driving behaviour (71%). The respective figures in the earlier study were 42% and 58%. The questions were asked in similar way in both interviews. The results show that the Road Weather Information is considered important, confirmed by the fact that around 75% of drivers said they had benefited from it compared with normal weather forecasts.

The importance of the information by the time of the day switched from morning (winter 1997–1998) to evening (1999–2000). This happened expectedly as the length of the forecast was increased after the first winter. There was no difference in the importance of weekdays.

When the drivers placed various presented weather and road condition situations in different categories, normal and hazardous conditions were more correctly recognised than poor conditions. The results showed also that the difference between hazardous and poor conditions is not well known.

Correctness of Road Weather Information

The aim of this part of the study was to evaluate accuracy of the information, how well the co-operation between the two main organisations involved has worked, and what kinds of problems have occurred when making the forecasts. Personnel at road weather centres were asked to estimate the need for providing information on roads other than main roads. They also collected feedback from the public.

The study was conducted using a road weather log sheet filled in at road weather centres. The personnel at Finnra entered the category given by the road weather forecast three times a day in the diary, after deciding on the category together with a meteorologist from the Meteorological Institute. Situations where the organisations had different views of the classification of road conditions were entered in the log sheets. The correct classification for the previous forecast was also examined and the reason for any differing classification written down.

Almost invariably (98%) the road weather classification was decided without disagreement. After each winter, more or less 90 % of the forecasts were estimated to have been correct. The rest were quite evenly balanced between low and high predictions. In 4% of situations it was noted that the slipperiness of minor roads should be mentioned to the public. There was also some public feedback concerning the conditions on minor roads.

The most important issue regarding the use of log sheets was that it allowed personnel involved in the Road Weather Information service to continually evaluate how well it has succeeded. This became especially apparent when the classification of road weather was re-estimated after the episode and any differences commented upon. This provided continual feedback on how well the service was working, and where there might be room for improvement.

Road Weather Information and Days with High Numbers of Accidents

The aim was to study how well very difficult road conditions and weather situations had been forecast on days with a high number of road accidents. Based on findings from earlier years it was estimated that roughly 5–10 days per year would have close to double the average daily rate of accidents. Some winters have seen even more days than this, with 15 in 1995.

The number of accidents was studied from data compiled from traffic insurance companies for the time period October – February¹. The share of accidents reported to traffic insurance companies of all the accidents has been estimated to be approximately 78% in Finland (TVH, 1982).

Here, an example on the evaluation of Road Weather Information and accidents is presented for winter 1998–1999 (Figure 3). Altogether 39 316 accidents were used in the analysis. Although the average daily number of accidents was 216 there was a wide variation in number (min 55, max 497). Each line presents the number of accidents during one day. The colours show the Road Weather classification for each accident.

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 there were more accidents than 80% above the average. Such days were also called “peak days”. Between these two categories, the accident number was categorised as “somewhat higher”. During the winter of 1998–1999 there were 7 days with a high number of accidents. The accident number was “somewhat higher” for 21% of the winter days.

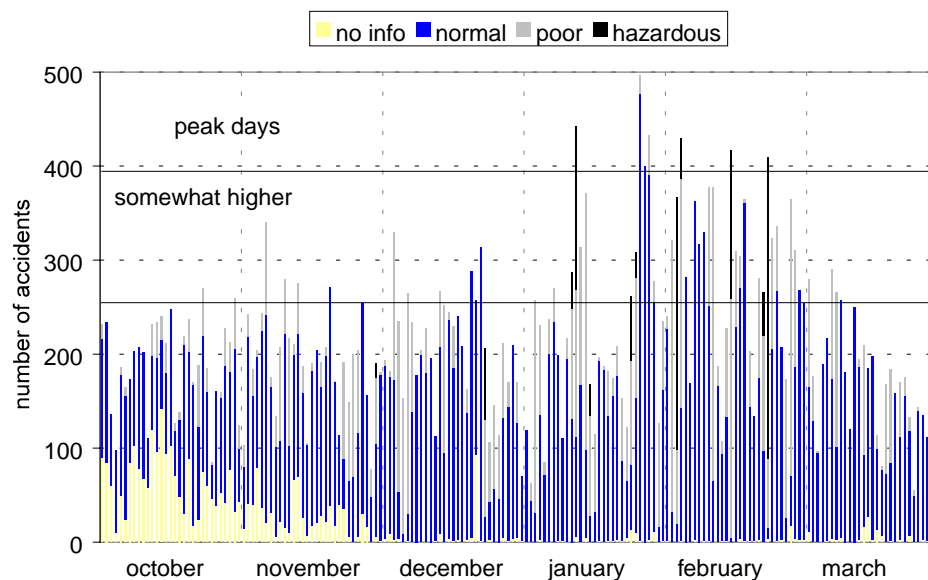


Figure 3. Example of Traffic Accidents for Road Weather Categories in Winter 1998–1999.

When the number of accidents was high, the road weather classification was “hazardous” in 3,5% of accidents, “poor” in 25% of accidents and “normal” in 72%. The comparison with the number of accidents in each Road Weather category and the respective accidents in these conditions showed that there occurred most accidents when the "hazardous" conditions had been forecasted.

Similar evaluation of the days with high number of accidents were made after each winter. The general conclusion was that the forecasts for the "hazardous" conditions were somewhat successfully given, the second winter 1998-1999 being the most successful so far.

¹ Due to the slow reporting (and therefore low number) of accidents, March was excluded from the analyses each year.

One specific aim of the Road Weather was to decrease the amount of warnings of "poor" road conditions, since it was experienced that the warnings had been used too often when the information had been based on weather information only. It was noticed that the amount of warnings had also been decreased with the new service. The information given on days with a somewhat higher than average number of accidents was fairly similar to that given on days with fewer accidents.

Detailed analysis of the "peak days" weather were made by the Meteorological Institute after each winter to get more knowledge on the most difficult weather and road conditions. These analysis have provided information that made it easier to forecast the most dangerous conditions.

Interviews of Experts

The aim of interviewing experts was to collect possible ideas for further improvement of the Road Weather Information service and also to evaluate how well the service has fulfilled its goals. The experts also estimated how well the co-operation between the two organisations (Finnra and Meteorological Institute) has worked out. A further objective was to identify any existing problems so that these could be handled as effectively as possible to further improve the service before the onset of the next winter. The experts were interviewed mainly at the place, but also some questionnaires were used if the expert lived outside Helsinki metropolitan area.

In general the service got very positive feedback, even though some drawbacks were mentioned. Almost all the experts interviewed concluded that the new system provides better information than the older one, but few of them did not find the new system to be an improvement. In general, the experts were satisfied with the presentation of road weather information on television and radio. Although the general opinions were positive, there were many suggestions for improvements: the terminology was improved, the length of the forecast was increased, the format how the information is presented to public was improved, the reason of the bad weather was presented in connection with the warning of poor or hazardous conditions: e.g. the road is slippery and icy etc.

The improved communication between Finnra and the Meteorological Institute was said to be a very positive aspect of the service. Communication was reported to be easier also on more informal issues after the first two winters in 1997–1998 and 1998–1999. However, when Finnra bought the weather forecasts from private weather forecast provider (winter 1999–2000), the communication between Finnra and Meteorological Institute was said to be "close to non-existent" especially in the beginning of the winter. This was then naturally considered as clear impairment in making the Road Weather forecasts and is was considered to affect the quality of the service. During the winter 1999–2000 the co-operation improved as the both authorities, Finnra and Meteorological Institute, learned to operate in the new situation.

Conclusions of Evaluation Studies

The Road Weather Information Service has been operating since 1997 and it has established its position as a source of information on road conditions and forecasts on road conditions – 90% of the interviewees recognised the service and a vast majority of them claimed that they get the Road Weather Information almost daily. Most drivers found the frequency of broadcasts on road conditions to be adequate and the effect of the Road Weather on their own driving behaviour was said to be marked. For example, 63% of drivers after winter 1997–1998 answered that the road weather information had a strong or very marked effect on the time they reserve for travel, and 71% said has a strong or very marked effect on their driving behaviour. These results indicate that the Road Weather Information affects not only drivers' comfort but also traffic safety. However, the share of drivers who knew the different Road Weather categories had decreased substantially from 54% to 33% in two years, which indicates that the content of the service should be informed more effectively to drivers.

According to the road weather diaries kept by the service, the classification was correct in more than 90% of forecasts. The rest, under 10%, of the situations were quite evenly balanced between low and high predictions. During the winter, the numbers of "peak days" altered from 6 days during the winter 1997–1998, to 7 days 1998–1999 and to 3 days 1999–2000. The forecasts improved after the start of the service, and during the winter 1999–2000 the "peak days" were forecast quite well. The number of the "peak days" was quite low, but one specific aim of the service had been to give out strong warnings only on the most dangerous days.

In general, the interviewed experts were satisfied with the Road Weather Information service, but raised still quite many issues that should be improved after the winter 1999–2000. Especially appreciated was the improved communication and co-operation between the Finnish Road Administration and the Meteorological Institute. One specific improvement would be to be able to better distinguish between "normal" and "poor" road conditions, since these do not differ clearly in comparison of numbers of accidents. However, it has been considered that even in this situation, the information on "poor" conditions should be presented so that the drivers are aware of the Road Weather Information.

In conclusion it can be said that the Road Weather Information service achieved a fair degree of success already in its first winter. The service was well known among car drivers and the effects were estimated to be large. The quality of the service has been also improved during the years of its operation. The positive results of Road Weather Information contributed to the development of "road conditions" information directed to pedestrians. This new service was tested in Helsinki region in Finland and it got very good acceptance especially among the elderly people. The problem of slipping accidents is a significant socio-economic problem in Finland.

Discussion

The Road Weather Information Service was started for winter 1997–1998 as a new service. The evaluation study was done for assessing the effects of the service and for further development. The various methods gave valuable comments and especially the expert interviews were of importance when the service was developed. The research project made it possible for an outsider to suggest various improvements and even criticism so that this resulted in improved practices and quality of service, even in the situations where the both authorities, Finnra and Meteorological Institute, had different opinions.

The evaluation results showed that the user's feel that the service is important and they claim to use it in wide extent. The accuracy and fast distribution of the information are important so that the people will benefit from these kind of information service even more when making their travel decisions. Road Weather Information is now widely distributed through radio and television. In current situation, these are the two main channels for information provision, but in the future it is likely that this kind of information will be broadcasted to the road users' vehicle.

Future

The Road Weather Information will be in operation every winter. The Road Weather Information can be seen as a "real content" for example for in-vehicle information systems, even though it should probably be modified to cover smaller areas etc. This is being especially true in the situations and areas where the changes of weather are difficult to forecast. Also, the time span of 24 hours, even though the changes during this period are reported, is quite long, which makes it desirable to develop more local forecast services that concentrate more in the next couple of hours. However, the overall picture of Road Weather Information will be valuable for road users in the future also.

One next step in near future is to study on site the effects of Road Weather Information in the situations when the road conditions are hazardous. This will be done during the winter 2001–2002 and the main object is to study how the information actually affected the road users.

The further development of various information services on road and weather conditions for drivers can be of even greater interest. In a Finnish study (Malmivuo et al, 2000), it was concluded that in future it is more and more difficult to gain significant traffic safety benefits by making traditional improvements on winter road maintenance measures, such as faster ploughing. When the level of winter road maintenance is already high, the various information services could be of use.

References

Estlander, K. 1995. *Sään ja kelin vaikutukset eri ajoneuvoryhmien nopeuksiin*. [Effects of weather on driving speeds]. Tielaitoksen selvityksiä 23/1995. Finnish National Road Administration. Helsinki 1995. 90p. + apps. ISBN 951-726-057-1.

Heinijoki, H. 1994. *Kelin kokemisen, rengaskunnon ja rengastyypin vaikutus nopeuskäyttäytymiseen*. [Influence of the type and condition of tyres and drivers' perception of road condition on driving speed]. Tielaitoksen selvityksiä 19/1994. Tielaitos, Liikenteen palvelukeskus. Helsinki: Painatuskeskus Oy. 99 s. ISBN 951-47-9098-7.

Liikennevakuutuskeskus. 1997. *Vakuutusyhtiöiden liikenneturvallisuustoimikunta (VALT). Raportti liikennevahinkojen tutkijalautakuntien tutkimista moottoriajoneuvossa kuolleiden onnettomuuksista vuonna 1996*. Helsinki. ISBN 951-9330-68-2.

Malmivuo, M., Karki, O., Makinen, T., *Teiden kunnossapidon yhteys liikenneturvallisuuuteen*. [Connection between road maintenance and traffic safety.] Tiehallinnon selvityksiä, 57/2000. Finnish National Road Administration, Central Administration, Traffic and Road Engineering. Helsinki 2000. 76p + apps. ISBN 951-726-705-3.

Malmivuo, M., Peltola, H. 1997. *Talviajan liikenneturvallisuus - Tilastollinen tarkastelu 1991-1995*. Tielaitoksen selvityksiä 6/1997. Tielaitos, Tienpidon suunnitteluyksikkö. Helsinki: Oy Edita Ab: 71 s. ISBN 951-726-317-1.

Nygaard, M., Rama, P., 1999, *Evaluation of the Road Weather Information Service in winter 1997-1998*. Finnra Internal Publications 59/1999. Finnish National Road Administration, Central Administration, Traffic Services. Helsinki 1999. 46p.

Nygaard, M., Rama, P., 2000, *Liikennesää-tiedotuksen arviointi talvikaudella 1998-1999*. [Evaluation of the Road Weather Information Service in winter 1998-1999.] Tielaitoksen selvityksiä, 24/2000. Finnish National Road Administration, Central Administration, Traffic Services. Helsinki 2000. 27p + apps. ISBN 951-726-652-9

Penttinen, M., Luoma, J., Rämä, P. 1997. *Information needs of Finnish drivers*. Proceedings of 4th World Congress on Intelligent Transport Systems, Berlin, Germany, 1997.

Penttinen, M., Nygaard, M., Harjula, V., Eskelinen, M., 1999. *Jalankulkijoiden liukastumiset, vaikeimmat kelit ja niiden ennustaminen sekä tiedottamiskokeilu pääkaupunkiseudulla* [Pedestrian slipping accidents, detecting and forecasting of hazardous road conditions. Information campaign on the Helsinki region.] 1999 . VTT, Espoo. 51p. + apps. VTT - Research Notes. ISBN 951-38-5609-7.

Rajalin S., Koivukoski, M. 1998. *Kuljettajien tiedot uudesta Liikennesääpalvelusta*. Liikenneturva. Helsinki.

Roine, M. 1993. *Kuljettajakäyttäytyminen kaarre- ja jonoajossa*. [Driver behaviour in sharp curves and queues on main roads]. Tielaitoksen selvityksiä 87/1993. Tielaitos, Liikenteen palvelukeskus. Helsinki: Painatuskeskus Oy. 34 s. ISBN 951-47-877-4.

Saastamoinen, K. 1994. *Liikennemäärät eri kelioloissa - Tiesääasemien kelitiedon ja liikenteen automaattisilta pisteiltä saadun liikennetiedon perusteella*. [Effect of road conditions on driving behaviour and properties of the traffic flow]. Tielaitoksen sisäisiä julkaisuja 14/1994. Tielaitos, Liikenteen palvelukeskus. Helsinki: Painatuskeskus Oy. 27 s. ISBN 951-47-8139-2.

TVH – Liikennetoimisto, LVY, Kehittämistoimisto Oy Erg Ab. *Liikenneonnettomuustilastojen edustavuustutkimus 1982, Osa IV; Pääraportti, yhteenveto erillistutkimuksista*, TVH 741939 – 1982. 64p. ISBN 951-46-5529-X.