Development of RWIS
- a new approach using accident-data

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ABSTRACT

This study focus upon winter road accidents and the relationship to weather and slipperiness. Data from the Swedish RWIS system is used in order to classify type of slipperiness and the severity of the situation in relation to the number of road accidents that take place during each specific situation. The result shows a very clear picture that the number of accidents increases with increasing severity of the situation. Most accidents occur during situation with rain and a surface temperature around 0°C and during situation with snow.

Keywords: Road climatology, RWIS, Winter road accidents, Winter maintenance

1. INTRODUCTION

Road weather information systems (RWIS) were introduced during the beginnings of the 1980ths as a tool for maintenance organisations to perform more efficient winter road activities. In Sweden and several other countries the systems were built up in somewhat different way compared to ordinary meteorological station networks. The development of local slipperiness was one of the key factors to be able to monitor. Therefore field stations were located in areas where local slipperiness was often developed early during specific weather situations. Shaded areas are an example of a part of the road where a cold surface could be found during morning hours if the road stretch is sheltered from direct insolation or during the evening if direct shot wave radiation is obstructed. Other type of typical locations where valleys were cold air pooling could result in lower than average surface temperature as well as an early decline in temperature during the evening.

The description of the general idea behind RWIS presented above gives an understanding of the fact that the possibilities of the Swedish way of building a system give many opportunities. However it requires a good understanding of the system as well as in climatology. Since the system was introduced the performance of winter maintenance as well as how the information from RWIS is used has changed in many ways. Today there is therefore a great need to develop tools that helps in interpreting the data collected at field stations and make them more useful as information regarding if a salting activity is necessary to perform or not.

The present study deals with this task and focus upon a way to grade different weather events in respect of how important it is to perform intense winter maintenance. As way of grading different events the number of accidents is used. The hypothesis is:

That it is possible to find a linkage between winter slipperiness events classified by use of RWIS-data and the number of accidents taking place during that situation.

If the hypothesis is true a further use of the RWIS-data could be achieved, i.e. the data is not only used as an information about the local road stretch where the station is located but as node in a system the classify the weather situation in a wider extent.

2. METHOD

I n this study accident data for two winter seasons where used. The data are collected by the police and gives information about type of accident, timing, location as well as many other facts. Only accidents that could be related to winter road conditions where used in the study. To be able to select these accidents from the entire

number of situations the slipperiness situation where classified for each accident for the time interval 0 to 6 hours before the accident. Only accidents that could be linked to slipperiness were selected and used in the study.

Regarding the RWIS-data it was classified in relation to type of slipperiness situation as well as graded in to four different classes depending on how sever the situation based on RWIS-data were.

The southern part of Sweden was used for this study. In total data where used from 20 counties and from two different winter seasons. In total 12 114 accident occurred during the two winters studied of which 5468 could be linked to slippery road conditions. The accidents were of the type that: person/persons was/were injured, badly injured or someone died due to the accident. Accidents that "only" caused damage to the vehicle was not included in the study.

3. RESULTS

Accidents that occurred in association with winter road conditions during the winter 1998 to 1999 are shown in Figure 1. The figure contains all type of weather events that could be cause slipperiness on the road, i.e. snow, ice or hour frost. As can be seen in the figure the number of accidents that occurs varies a lot during the winter. No general trend could be depicted but rather a random pattern. The important finding is that selected days could be identified that give rice to a very large number of accidents.

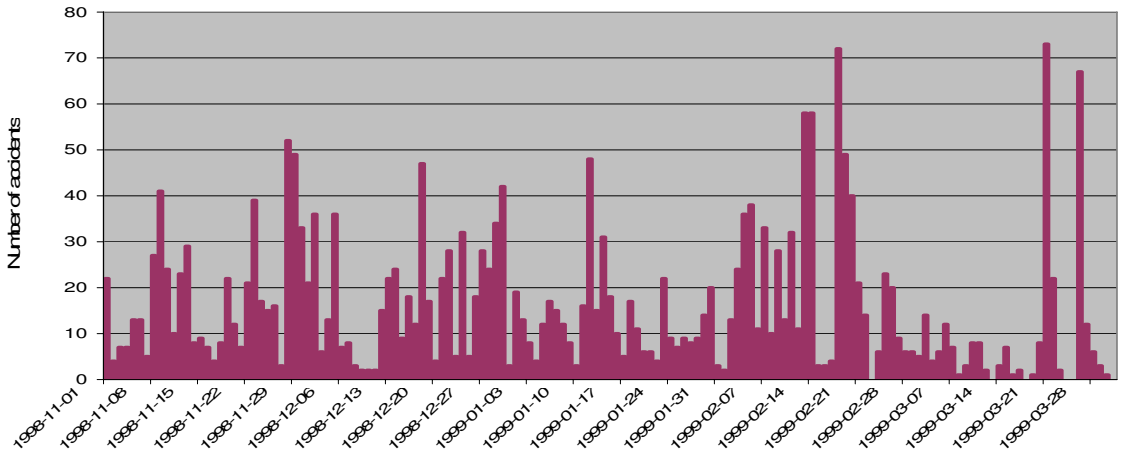

Figure 1. Variation in number of accidents occurring during a winter situation.

In table 1 the number of situations is shown in relation to how many accidents that takes place during the winter season November 1998 until March 1999. Only situations with a very high number of accidents have been selected for further studies of the relationship between weather and road winter accidents.

Table 1. Number of situations when a specific number of accidents occur during the winter 1998/99.

Number of accidents	**Number of situations**
More than 40	12
More than 50	6
More than 60	3
More than 70	2

From table 1 and figure 1 it is possible to see that during quite few situations a very large number of accidents occur. That means that by performing intense maintenance activity during a selected number of days the total number of accidents could be reduced significantly. The problem is of course to be able to identify these situations in advance and perform activities in such a way that the severity of the situation is reduced.

For the two studied winters there is a clear picture regarding which type of weather situations that most accidents occur. As shown in figure 2 rain in combination with low surface temperature is the type of situation when most accidents occur. Snow with a surface temperature above -3°C is the second worst followed by ice and cold snow events.

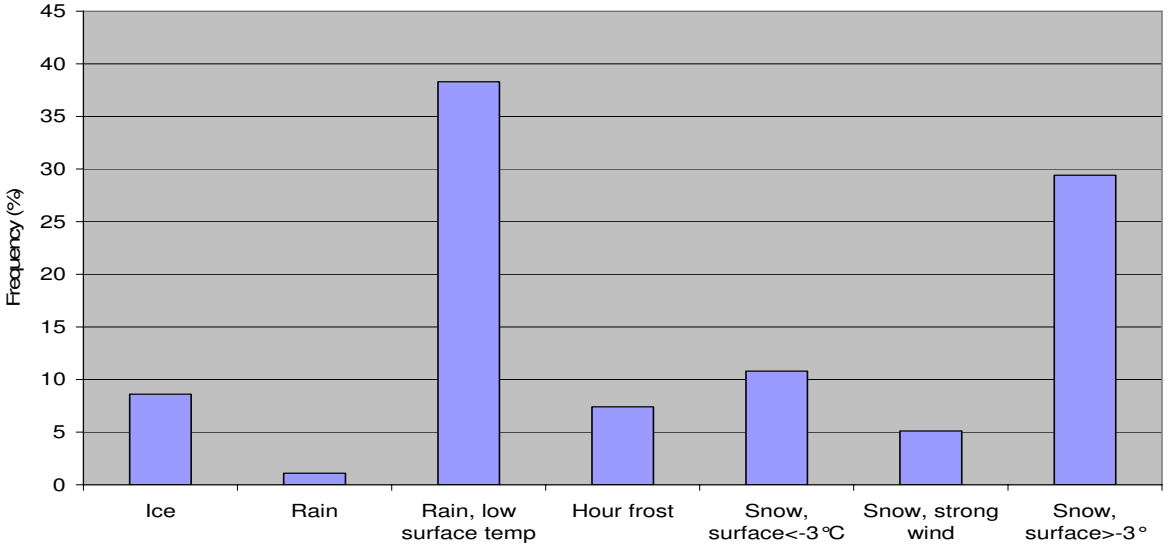

Figure 2. Frequency of accidents for different type of slipperiness types (for situation with more than 40 accidents).

Another important result from analyse of the weather-accident data was that the number of accident increased significantly with increasing severity of the situation. The severity was calculated in relation to:

- amount of precipitation for snow events
- thickness of hour frost accumulation in relation to wind speed, humidity, temperature
- probability that a temperature drop from plus to minus degree Celsius could lead to black ice formation
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Table 2. Frequency distribution of accidents in relation to severity of all types of slipperiness situations.

Severity level	Frequency of accidents (%)
1	13
2	13
3	22
4	52

In table 2 the number of accidents is shown in relation to the severity class. During the most sever situation the largest number of accidents occur. This is a very important result as it indicates that information regarding the severity of a specific situation could be very useful from maintenance point of view.

4. CONCLUSIONS

In this study it has been shown that a classification of slipperiness events using RWIS-data is a very useful tool to be able to determine which type of situation that is the most sever from an accidental point of view. From analysing the number of winter road accident occurring during a specific day a good indication of the variability can be obtained. By adding a classification code to each event a grading between the different types of situations could also be obtained. The result clearly shows that most accidents occur during situations classified as rain on cold surface and snow with a surface temperature above -3°C.

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