

Road Weather Forecasts for a Winter Road Maintenance Information Center

Wolfgang E. Raatz * and Ludwig Niebrügge**

*Deutscher Wetterdienst, Entwicklung von Anwendungen
Frankfurter Str. 135, D-63067 Offenbach, Germany
wolfgang.raatz@dwd.de

** Landesbetrieb Straßenbau Nordrhein-Westfalen
PO Box 4669, D-48026 Münster, Germany
ludwig.niebruegge@muenster.strassen.nrw.de

1. Introduction

Since the early eighties an increased number of road weather monitoring stations have been installed along the „Autobahnen“ of the German national highway system in order to monitor the weather conditions and their effect on the state of the roads. The introduction of Germany's road weather information system (SWIS) has led to a dense network of road weather monitoring stations. The data of these stations is used by the German Meteorological Service (DWD) to monitor actual road weather, to predict road weather conditions (especially in the nowcasting range) and to develop new forecast methods.

The data of these stations was also monitored by the personnel at the telephone center of the local maintenance center. In addition, information on the road condition was passed on to them by the highway police. When there was a risk or the occurrence of slipperiness the winter road maintenance staff was alerted by the telephone center.

The quality of the road weather monitoring varied heavily, depending on the ability and experience of the personnel at the telephone centers. The interpretation of the data and of the alerts provided by the road weather monitoring stations in connection with the weather development and predictions was often carried out in an unsatisfactory manner. There was a lack of knowledge, which could not be removed by additional training.

Due to these experiences and the intended closing down of the telephone centers, the necessity of re-organizing the road weather monitoring system and the coordination of winter maintenance became apparent. In this paper we will describe how the coordination of winter road maintenance has changed in the state of Northrhine-Westfalia (Nordrhein-Westfalen) and its possible effects on the cooperation between the road administration and the German Meteorological Service (DWD).

2. Objective and Tasks

The economic importance of the roads as a means of transportation imposes high requirements on the winter road maintenance. Every day, the national highways, which fall under the responsibility of the department of highway construction of the „Landesbetrieb Straßenbau Nordrhein-Westfalen“ are used by 67.500 vehicles. In the industrial center of the Ruhr region traffic flow regularly peaks at 110.000 vehicles per day. Since it is estimated that traffic flow will further increase, there is a need to continue efforts to optimize winter road

maintenance and its coordination. A thorough analysis came to the conclusion that it would be advisable to set up a winter road maintenance information center, the first of its kind in Germany.

First of all, the winter road maintenance information center has to have access to all relevant road weather data and forecasts. In addition, the staff has to be trained to interpret the data. Furthermore, the winter road maintenance information center has to have knowledge of the status of the winter road maintenance done by the different local maintenance centers.

Primary tasks of the winter road maintenance information center are:

- a) monitoring of the road weather data and their development,
- b) monitoring of the weather development using additional information (e.g. such as radar),
- c) comparing actual weather and predicted weather,
- d) calling the winter road maintenance centers to start service,
- e) coordinating the winter road maintenance done by different centers.

Secondary tasks are:

- a) keeping records of the the winter road maintenance information center's activities as well as of those done by the different maintenance centers,
- b) checking the technical condition and reliability of the road weather monitoring system (quality of measurements, data transfer, etc..),
- c) checking the operation of thawing agent spraying systems.

3. Technical Equipment and Staff

The winter road maintenance information center is equipped with several personal computers which are linked to the SWIS-network. They display simultaneously different parameters of the road weather monitoring stations, the DWD's forecasts as well as precipitation images. A further PC is linked to the internet and is used to gather additional weather information from the World Wide Web.

The different local maintenance centers are also linked to the SWIS-network in order to ensure that,

- a) exchange of information and coordination between the winter road maintenance information center and the different local maintenance centers can take place on the basis of the same data,
- b) the person in charge (e.g. road master) of the local road maintenance center is able to evaluate the state of the roads in his/her network of responsibility,
- c) in the event of network problems the task of monitoring road weather can be handed over from the winter road maintenance information center to the local maintenance centers.

Finally, the winter road maintenance information center is equipped with a fax machine and a modern telephone system.

During the winter months the winter road maintenance information center is manned 24 hours a day. The staff consists of 5-6 persons, who have practical experiences in carrying out winter road maintenance. They are especially trained in evaluating road weather data and the

alerts/alarms issued by the monitoring stations. In addition, they receive background knowledge in basic meteorology.

4. Main Tasks

4.1 Monitoring of the Road Weather Data and Their Development

As many as 100 road weather monitoring stations report every other minute their actual data. In addition, they provide trend forecasts and different types of alerts and alarms. In order to easily evaluate these forecasts and alerts/alarms it has been decided to use sensors from one manufacturer only.

4.2 Monitoring of the Weather Development Using Additional Information

In order to organize winter road maintenance activities and to achieve a longer lead time before having to start winter road maintenance it is important to have good forecasts on the weather development. Different information sources are used:

- a) various forecast products provided by the German Meteorological Service (DWD) as part of SWIS (3-day forecast; 24-hrs detailed forecast for small climatic regions, sub-divided by 200 m altitude intervals; road weather advice with up-to-date information as to expected meteorological developments within the next 2-4 hours),
- b) images from the DWD's precipitation radar network,
- c) data from road weather monitoring stations from neighbouring road administrations,
- d) in critical situations telephone communication with the forecasters at the regional forecast center of the DWD.

Using all these different information sources the staff of the winter road maintenance information center has a better overview on the road weather situation than the persons had at the telephone centers. In addition, the quality of the weather forecast can be better judged, an update of the forecast may be demanded if necessary.

4.3 Alerting and Coordinating Local Winter Road Maintenance

Alerting the local winter road maintenance takes place on the basis of the information described above. During regular working hours of the local maintenance center the decision to carry out winter road maintenance is made by the road master. Outside regular hours the responsibility is handed over to a certain person. The individuals initiate the necessary actions for their network. Thus, the winter road maintenance information center only passes on information, decisions are made locally.

Coordination of local winter maintenance by the winter road maintenance information center should be restricted to those cases when the winter maintenance crews have to operate outside their road network. For example, the winter road maintenance information center may order an already operating salting vehicle to continue salting in a neighbouring territory in order to remove slipperiness at certain critical spots. This may avoid calling in extra personnel and machinery, thus saving costs and time.

In the event of extreme weather conditions, such as intensive snowfall, coordination of the maintenance crews becomes necessary. When problems of capacity arise at one maintenance center they must be alleviated by available resources from other centers. Because of its advantage of having more and better information the winter road maintenance information

center can initiate the necessary actions much faster. Extreme situations can thus be dealt more effectively and traffic jams may be avoided.

5. Experiences and Outlook

The winter road maintenance information center has been operating for 4 years. It has led to an increased efficiency in the organization of winter road maintenance and has improved its quality.

The participation of the winter road maintenance information center in alerting the local maintenance centers has increased to 90%.

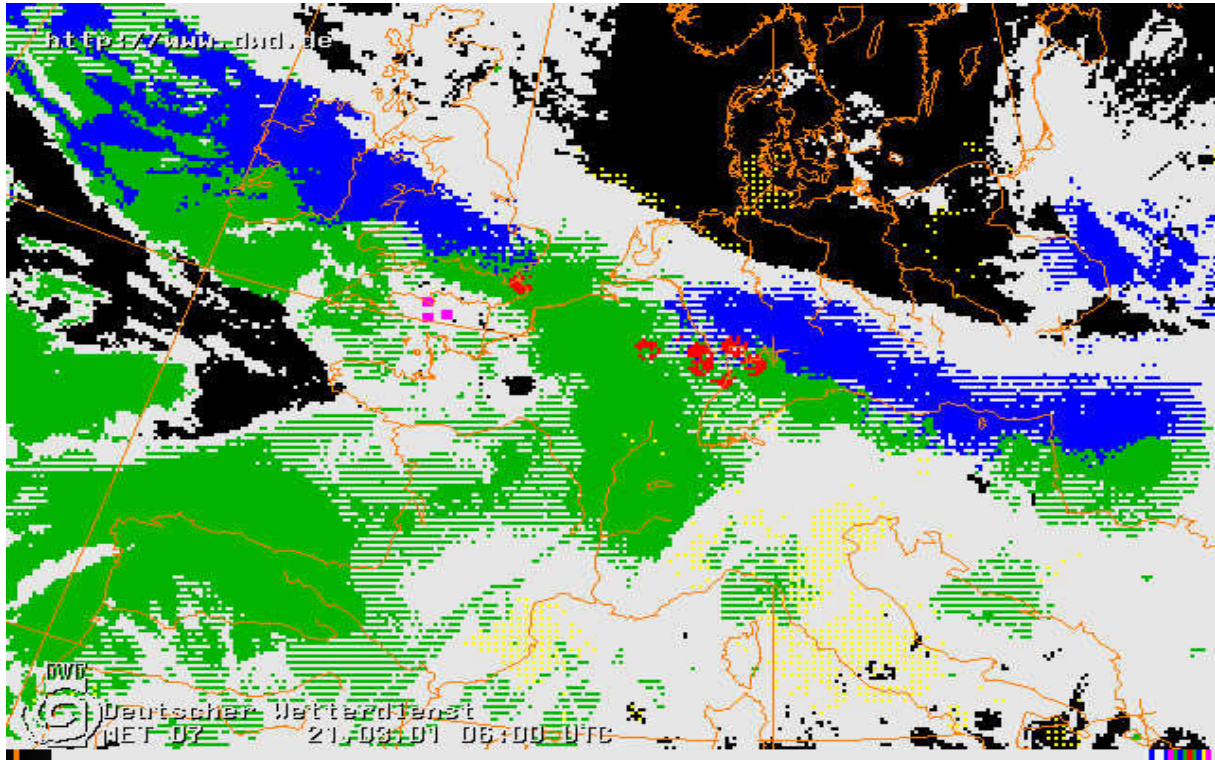
Developments of road weather conditions could be anticipated with much more accuracy due to the ability and knowledge of the staff. Therefore it was possible to raise the number of preventive operations by the winter road maintenance.

The dialogue between the forecasters of DWD and the center's staff has improved the evaluation of the weather situations. Due to the numerous information the center's staff was able to discuss the weather situation with the forecaster in greater detail. They became competent partners in evaluating the weather situation and were better prepared to anticipate further weather development. Thus, cooperation was put on to a much higher level of understanding than in the past.

Therefore, the German Meteorological Service (DWD) is planning to upgrade its forecast products within the frame of SWIS using internet technology. When the staff of the winter road maintenance information center becomes better trained and competent, the forecast products may become more detailed by containing more complex information. Additionally, nowcasting products will supplement the long and short range forecasts. An example is given in Figure 1. This product is called „satellite weather“. Information from satellite images and synoptic observations have been combined, extrapolation up to 3 hours can be done. In contrast to former times, forecast products may be issued several times a day, being more up-to-date.

Since the winter road maintenance information center has the problem how to display information from different sources and make them comparable, the DWD may provide a presentation software to display all meteorological information.

Figure 1: Example of a nowcasting product called „satellite weather“. The analysed product can be extrapolated up to 3 hours. The results are fairly good for stratiform clouds, less accurate for convective weather phenomena.



- | | | | |
|---|---------------------------------|---|--|
|  | freezing rain, freezing drizzle |  | rain (stripped: little) |
|  | snow (stripped: little) |  | clouds without significant weather phenomena |
|  | thunderstorm |  | no significant clouds |
|  | fog (dotted) | | |