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# Use a route based forecast for dynamic gritting

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**ABSTRACT**

Measurements show large local differences in road surface temperatures along a road, sometimes more than 5°C. These large temperature differences are due to local environmental factors. During clear and calm nights when the average road surface temperature is around 0°C some parts of a road are safe while others are critical. With a high quality route based forecast system, these parts can be distinguished. This information can be used to make the gritting process more efficient.

**Keywords:** road surface temperature forecast, dynamic gritting, route based forecast.

## 1 INTRODUCTION

During the winter season slippery roads can cause severe accidents. Local and national authorities will grit roads to prevent dangerous road circumstances. However when road temperatures are around 0°C, not all parts of the road will need gritting. It is important to know which parts need more salt than others, in order to gain both financial advantages and less environmental damage by salt. MeteoGroup's route based forecast system gives detailed information about the road surface temperature and condition. This makes the gritting process can be made more efficient.

## 2 TEMPERATURE DIFFERENCES

Measurements show large local differences in road surface temperatures along a route of up to more than 5°C in clear and calm nights. Those temperature differences can be explained by environmental factors. For instance a road in an open area without any buildings or trees can behave differently from a road in a sheltered area (see Figure 1). Sheltered areas can consist of urban or rural areas where buildings or trees provide sheltering.

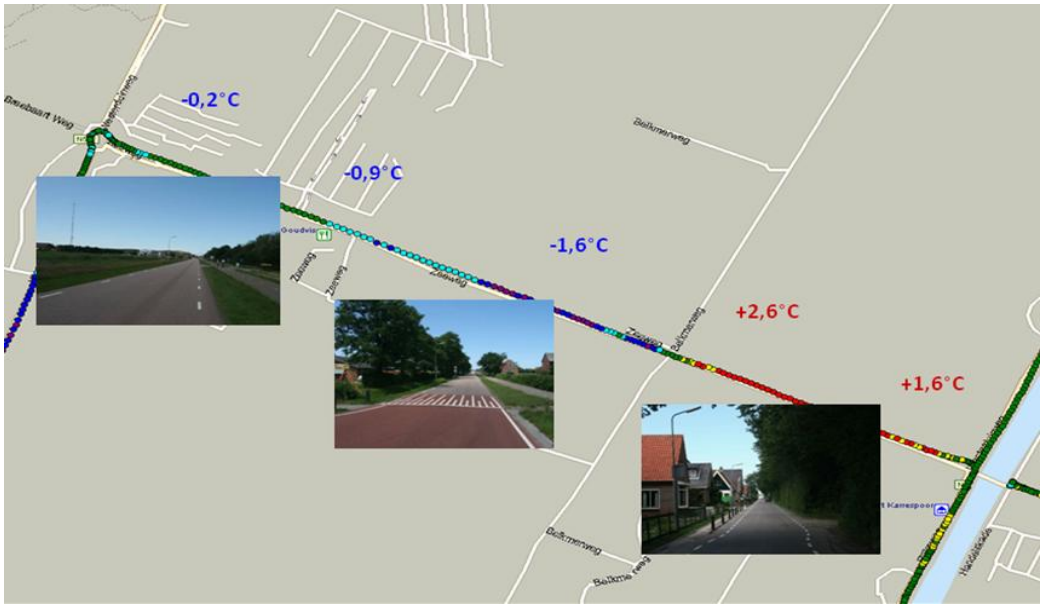


Figure 1. Infrared measurement of the road surface temperature. Sheltered areas show as higher temperatures (right side of the figure), open areas appear as lower temperatures (left side).

Due to the different behaviour of road sections during nights with road surface temperatures around 0°C, there may be both safe and critical parts in one gritting route. With a high quality route based forecast system, those safe and critical road sections can be distinguished in the forecast (see Figure 2). This information can help to make the gritting process more efficient.

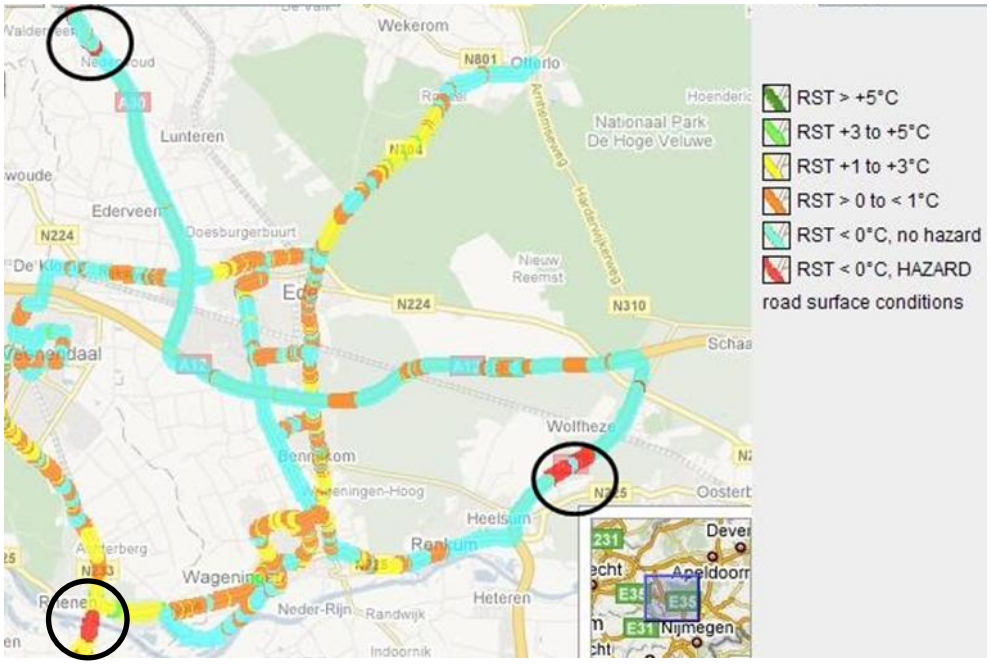


Figure 2. In this output of the MeteoGroup route based forecast for road surface temperature and condition, the critical areas (red colors within the circles) can easily be distinguished.

Main factors influencing the road surface temperature forecast are local weather conditions, sky view and solar view. A local air temperature measurement and thermal map information can be used to improve the forecast. Moreover the forecasts are scaled with road sites on the route.

## 3 DYNAMIC GRITTING

MeteoGroup is involved in a joint pilot project with governmental partners. The main goal of this project is to apply the route based forecast system in their operational gritting strategy. The road surface temperature and condition forecasts are directly communicated to the gritting machines. Based on this information, gritting actions can be optimized in two different ways:

1. Dynamic gritting: use a variable amount of salt, which is automatically determined based on the road surface temperature and condition forecast.
2. Dynamic routes: the gritting routes are optimized in order to treat the most critical places first.

Normally road weather information systems (RWIS) are situated at the coldest parts of a route. This means that in marginal nights with temperatures around 0°C the main part of the route will stay above zero and only the coldest spots will become critical. If a road authority makes its decision only based on the RWIS, the entire route would be treated. In this case dynamic gritting can be very useful.

When a RWIS is not at the coldest part of a route, for example when no electricity is available at the right place, a route based forecast can help to give a good indication of the risks on the entire route.

First results show that in a snowy winter like 2010-2011 in approximately 20% of the cases dynamic gritting could have been applied in the Netherlands. In more normal winters this percentage will be significantly higher, probably more than 50%. For safety reasons, the gritting machine measures the road surface temperature during gritting. This information can be used to validate and fine-tune the model. Next to financial and environmental advantages, dynamic gritting will help to increase safety on the roads.

## 4 CONCLUSIONS

Local weather and environmental conditions cause large differences in road surface temperature along a gritting route. By using a route based forecast of road surface temperatures and conditions, a significant number of the gritting cases can be treated dynamically. Dynamical gritting offers not only financial and environmental advantages, but also helps to increase road safety.