Presentation 6.3

ROUTE BASED ROAD CONDITION FORECAST USING MOBILE SENSORS

Karl E. Schedler[a], Karl G. Gutbrod[b]

[a]*KS-Consulting, Alpgaustr.22, Oberstdorf, DE,*
[b]*meteoblue AG, Clarastrasse 2, Basel, CH*
karl.schedler@ks-consulting.de

In the R&D project FE040279 "Route based sleekness prediction", methods for the more accurate prediction of winter-related sleekness were tested over 2 winters (2015/16 and 2016/17) and 3 road networks ((A-4, A-9, St2139). Therefore, new concepts were compared and tested in a 5-step process, including (1) weather models, (2) point forecasts, (3) roadway forecasts, (4) route forecasts and (5) temporal variability (gradients)

The routes A-9 (about 50 km, 380-520 m above sea level) and St-2139 (14 km, 480-901 m above sea level) have varied topography and terrain characteristics interesting for meteorological conditions. For the characterization, they are equipped with 3 resp. 1 stationary weather stations and were measured almost daily in the two winter half-years for a total of more than four hundred drives with mobile sensors (MARWIS from company Lufft) installed on maintenance trucks. The following parameters were recorded: dew point and road temperature, water film height and ice percent, as well as supporting parameters such as friction, road conditions and time-based radiation.

The measurements showed a high variability on the routes, reach within a drive differences of up to 17°C for temperatures and 2000µm for water film heights. This variability correlates little with the measurements at the stations and is not detected well by any prognosis provider.

The forecasts reached an MAE of 2.3°C for stations and a MAE of 2.1°C compared to mobile measurements on the road. For water film height, an average error of 180 µm is reached.

On the basis of the mobile measurements, standard profiles of the temperature were made by classification according to weather conditions, which allow to reduce the forecast error for temperature from 2.1°C to 1.9°C, and with the help of nowcasting to 0.6°C. A forecast for the next 12 hours should be able to achieve an error (MAE) of 1.2°C using these methods.

For the water film heights, standard road profiles of the water film height were created with mobile measurements and classification according to the amount of precipitation, which allowed to reduce the prognosis error for water film height from 190 µm to 90 µm and with nowcasting to below 50 µm. A prognosis for the next 12 hours should be able to achieve an error of less than 100µm using these methods.

The methods were developed using data from 2015/16 and tested on the journeys of 2016/17 so that an application is scientifically secured to independent journeys and other routes. It requires the creation of regular mobile measurement profiles, which are classified as standard profiles. On the basis of the experiences of 2 winters, a training of the model is likely to be possible within a winter season, during which improvements could be made to the route predictions.

The new methods represent a significant improvement in the state of the art and can be introduced into the practice within a few months using appropriate measures.

This R&D work was performed on behalf of the German Ministry of Transportation (BMVI) and the German Highway Research Institute (BASt) in Bergisch Gladbach.
We acknowledge the support of Horst Badelt and his Team from BASt as well as the support of the center of road maintenance at the North-Bavarian Highway directorate and the workgroup teams at Greding and Viechtach. .