ADVANCED ROAD WEATHER AND MAINTENANCE INFORMATION SYSTEM IN THE CZECH REPUBLIC

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In this paper, we would like to present the national road weather and maintenance information system used in the Czech Republic. The system is based on METIS platform with other connected services. METIS has been developed and used for supporting winter road maintenance in the Czech Republic from 2003 and nowadays it provides many useful modules for decision making as well as for maintenance management. METIS is a software product of the company CROSS Zlin, but as a national road weather information system, it integrates several data sources and services from other parties contracted by the national road authority.

This is also the main advantage of the system, that it concentrates all weather-related data and information into a single application so that the maintenance dispatcher and even maintenance manager has everything at fingertips.

The METIS platform is flexible and open to implement local specific products or integrate third-party services if it is implemented in any other country. In the past, METIS was implemented in different trials also in Sweden, Serbia, Slovakia, and Georgia.

During the years three key modules have been established to fully support the whole process of winter road maintenance. First, road weather information system. Second, maintenance decision support system. Third, maintenance information system.

Road Weather Information System (RWIS)

METIS is used as a national RWIS in the Czech Republic for more than a decade as a long-term service for the Czech national road administration. METIS is a web-based system for presenting all kinds of weather-related information to support decision making of winter maintenance personnel. Main parts are the status map, weather stations, cameras, radar and satellite pictures, text forecasts, MDSS (see below), vehicle tracking, and MIS (see below).

METIS is technology-independent which means that it can integrate data from different stations from different manufacturers. Basically, a central server is responsible for collecting and validating data from different stations or repositories and storing them in a unified format in a central database. METIS then visualizes the data, no matter if it is Vaisala, CrossMet or any other station.

In the mid-90's we have started to construct and operate road weather stations in the Czech Republic. The first technology originated from Vaisala, later on, other stations were added like domestic CrossMet or Lufft. In 2018 there are approximately 600 road weather stations from six different producers throughout the Czech Republic, all integrated into METIS.

Most recently, we are really proud of integration of an innovative meteorological camera called 2DRoad in the Czech Republic, which is the first road sensor worldwide which scans the road surface in two dimensions in an area up to 6 x 6 metres wide providing road condition and friction. This hi-tech sensor is a highly beneficial solution for road weather monitoring and supporting decision-making of maintenance personnel in an entirely new way.

METIS is available for the end users online using a standard web browser – it means from anywhere and without any special requirements. The system offers also an alerting service using SMS messages or emails in case of detection of critical road or weather conditions.

Maintenance Decision Support System (MDSS)

MDSS stands for a maintenance decision support system, which is a specialized system providing the dispatchers of winter road maintenance with the road surface forecasts and also treatment recommendations.

Road surface forecast is based on a CROSS – Klimator scientific core (SSWM model) and using ALADIN numerical weather prediction model. A scientific core allows unique spatial forecasting of road surface temperature and road condition for each 1km road stretch for next 12 hours which provides the possibility of maintenance planning and even selective maintenance. Spatial modelling is very effective mainly in case that the thermal mapping is available for the particular road stretch.

Treatment recommendations are based on road surface forecast and are focused on defined maintenance areas. The algorithm analyses the need for chemical treatment and ploughing in every maintenance area in next 12 hours, including recommended salt dosage.

The outputs of MDSS forecasts are implemented in METIS as a map-based color-coded animation of covered road stretches. Treatment recommendations are presented as a set of graphs, including meteorological diagram (meteogram).

Maintenance Information System (MIS)

MIS is an important part of the RWIS focusing on maintenance personnel and managers. METIS offers the interface for maintenance reporting (manual or automatic based on GPS data from connected vehicles), the unique system of validation and evaluation of maintenance activities in comparison to recorded weather conditions (see WMi below) and even automated invoicing tools.

In case there are maintenance vehicles tracked by any telemetric unit with GPS location (which is obligatory nowadays for all class I roads in the Czech Republic, approx. 1000 maintenance vehicles), METIS provides an extensive interface for visualization of movement and activity of those vehicles. The vehicle tracking system integrated into METIS uses the PROTANK DYNAMICS engine developed by the Czech company R ALTRA. This engine uses a standardized XML protocol for receiving the data from connected vehicles so the system is independent on the GPS system installed in the vehicle.

Based on the GPS data METIS can provide very effective reporting of maintenance performances like daily consumption of salt and kilometres of spreading and ploughing for MIS. Controlling of maintenance activities is also possible thanks to the central electronic maintenance logbook which is again obligatory for all contractors working on class I roads.

Further, the Winter Maintenance Index (WMi) is used to analyse and control the adequacy of performed maintenance. The intention is to 1) support sustainability – detect unnecessary over-reactions which mean over-pricing of maintenance, and 2) unify the standard of maintenance throughout the country using an innovative way of comparison of regional standards of winter maintenance of different contractors – in other words, we want the same level of safety, mobility, and efficiency across the country.

WMi has been developed and used in the Czech Republic since 2003 and has been nominated for Intertraffic Innovation Award in 2008. The system controls the performance of winter maintenance (kilometres of spreading and ploughing, consumption of salt, brine, and grit) on all highways and class I roads in the Czech Republic and the experience confirms that it really helps to optimize maintenance activities, maintain the quality of maintenance and keep overall costs under control.

Conclusion

In recent years, when the system is supporting the maintenance operations according to new contractual terms between the road administration and the contractors, we have very positive feedback from both sides regarding all RWIS modules. The system indeed proved itself to improve the efficiency of processes of decision making and subsequent reporting and control activities.

According to the analysis done by the Czech Ministry of Transport in 2014, the METIS system with all its modules helps to optimize the costs for winter maintenance by 26 % (cost reduction) with a higher quality of winter maintenance service.

Another Czech experience is that an important aspect of well-performed maintenance is also a special annual training of winter road maintenance dispatchers. The last period of such training was attended by 550 dispatchers from all maintenance areas working on class I roads in the Czech Republic.

All the above-stated services and activities confirm our long-term enthusiasm for road weather and broad experience in the field, which we would like to share with SIRWEC members when we get a chance.