New Developments in Roadside Weather Monitoring and Prediction Systems

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1. Introduction

Achieving winter maintenance cost savings, while maintaining highway safety and minimising damage to the environment, is a key concern to highway authorities and operators alike. Various weather monitoring systems are available to provide those responsible for winter maintenance operations the ability to manage their operations more effectively.

However, whereas the range of technologies and marketing approaches differ widely, the essence of a reliable and accurate weather information system is the quality of data input and how this is presented to the user.

This paper will describe both of these key aspects, as relating to the ICELERT weather monitoring and prediction system and will report on winter trials undertaken jointly in the UK and mainland Europe.

Recent developments which will reported on will include software data presentation, communication links and surface sensor technologies.

2. Road Surface Sensors

The ICELERT weather monitoring system can be configured to provide visual roadside indicator for authorities and road users alike when ICE formation or hazardous road conditions are predicted. Alternatively, additional sensors and forecasting agency information and communication links can provide a comprehensive data package to the winter maintenance operator of engineer. The first stage in achieving winter maintenance cost savings however, is the selection of the road surface sensor and to some extent the weather monitoring outstation.

The heart of a roadside weather system is the road surface sensor and although the ICELERT range of surface sensors have been established for many years and extensively used in a number of countries, in response to market demands, a new intelligent surface sensor (IRS) has been developed.

The IRS is the most advanced surface sensor available and can be connected to any data logger or, through an appropriate interface, to any Variable Message Sign (VMS) or illuminator, in order to present the motoring public with information on road surface conditions. In common with all ICELERT surface sensors the IRS measures surface temperature, condition (wet/dry/ice/frost) and state (normal/standby/critical) along with three levels of salt concentration and this key data is used in all subsequent winter maintenance decision making processes.

The key to winter maintenance cost savings is the effective planning of anti-icing operations. When the data provided by the IRS, or any other ICELERT surface sensor, is coupled with meteorological forecasting agency 24 hour forecasts, planning for this forecast period can take place. This then results in significant labour and vehicle cost savings by applying anti-icing chemicals **prior** to ice formation. The determination of the surface de-icing chemical concentration is crucial in planning anti-icing actions, thus saving costs and helping the environment and the IRS provides this relevant information.

Data recorded over the winter trials will be presented and this will be in conjunction with a description of the new software package which has also been developed.

3. Software and Communications

The new ICELERT for Roads software, which has been developed in conjunction with the English and Welsh ICELERT user group is a Windows based package and has significantly increased the level of operational features available to the user and gives winter maintenance engineers more control of their weather monitoring and prediction systems.

The simple, accurate and relevant data displays are in a format to allow winter maintenance engineers take operational decisions rapidly and before ice formation, thus saving costs and improving road safety.

The key features and benefits of the software will be discussed along with the presentation of actual data recorded over the winter trials. Thermal Maps and tabular and graphical displays form the basis of the ICELERT software. However, a new comprehensive suite of messaging, communication and polling facilities have been developed and are all under user control.

The ability to extract historic data into commercial spreadsheet packages such as EXCEL has been shown to be of considerable benefit and enables users to prepare reports and presentations. Road surface information and forecast data provided by forecasting agencies, will be compared and discussed, along with a full description of this software package.

Data transfer between the weather outstations and computer based Master Stations has historically been undertaken with Private lines, radio or through the public switched telephone network (PSTN). Recent experiments have been undertaken to assess both analogue and digital cellular telephone networks with a view to providing an additional communication path.

The experiments undertaken have confirmed that reliable communication links can be established between remotely located weather outstations and master stations and data is reliably transferred when required. The result of this development will be discussed briefly.

4. Conclusions

New developments in winter roadside weather monitoring and prediction systems have resulted in new enhanced software being written and tested. This has shown to give the user more control of their winter weather operations.

The possibility of increasing the number of communication paths between the roadside weather stations and the winter maintenance engineer's control facility has been demonstrated through the use of digital and analogue cellular links.

Finally, new innovative road surface sensors have been tested and data resulting from winter trials is to be presented, along with a comparison between actual and forecast data.