New possibilities by combining passive and active measurement surface sensors

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ABSTRACT

Detection of the de-icing chemical concentration in terms of Freeze Temperature is still an important key parameter for winter maintenance decision support systems. There are many reasons for choosing passive measurement methods for the detection of freeze point, for example the quick response time, low power consumption, and the application of well know type of salt mixture and so on. But there are also many reasons for choosing active measurement methods, for example at airports, where often non dissociating de-icing chemicals are used and so on.

An active sensor is only capable in measuring the freeze temperature and also not able to provide accurate measurement of surface temperatures because of the influence of the necessary cooling and heating energy. And also detailed surface condition classes are not supported by active sensors.

A well know manufacturer and developer of passive and active surface sensors recently now introducing an innovative solution in combination of passive and active measurement transducers.

The combination is able to provide all useful parameters for winter maintenance decision support and also for traffic control purposes. The Parameters are for example active Freeze Temperature, detailed surface condition classes, salt concentrations, surface temperature and waterfilm depth and a lot more.

The paper describes the basic technical solution and field application results. There is also a comprehensive comparison between the different surface condition detection methods in-pavement and non-invasive technologies.

Keywords: Road Weather Information, Freeze Temperature, Road Surface Condition

1 THE MOST RELIABLE MEASUREMENTS FOR ROAD/RUNWAY SURFACE CONDITIONS UNDER WINTER CONDITIONS

A combination of passive and active sensors is the preferred solution for reliable data for winter on-time treatments. Information such as surface temperature, water film height, Freeze point temperature are a prerequisite for good decision making. LUFFT has now tested a perfect sensor combination, a passive and active sensor, which are connected to the same measurement digital communication bus. Both sensors can exchange their reported data. Therefore the road condition detection, which need also measurement performed by passive sensors, but also need the freeze temperature in order to consider it by classifying the danger of slipperiness.
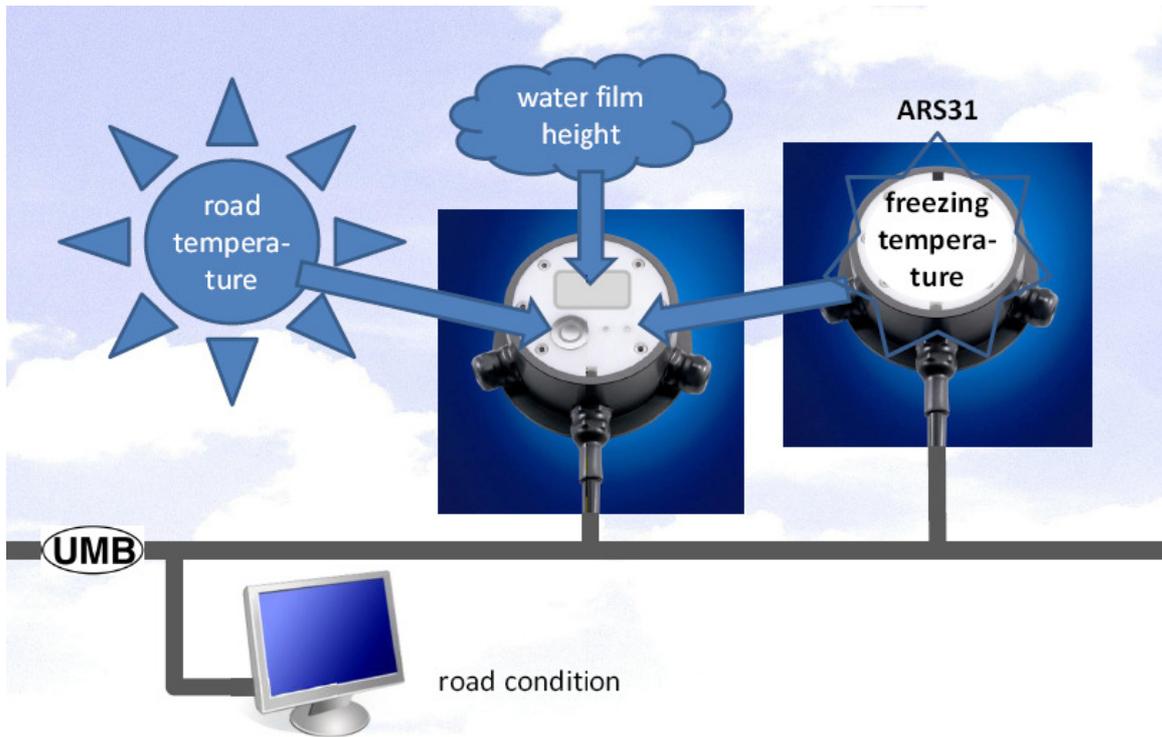

Figure 1: Passive and active Freeze point temperature sensor in one bus

Both sensors determine the road surface temperature, the liquid solution thickness and the freeze temperature of the water solution on the surface in it's best way.
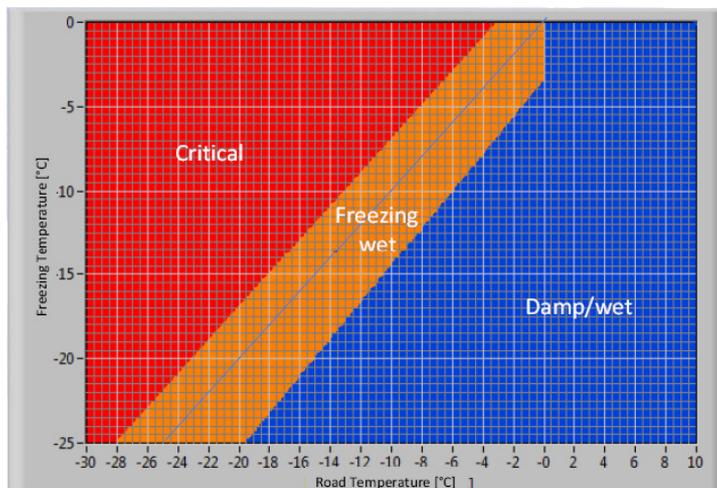

Figure 2: Critical Road Condtion

2   CRITICAL ROAD CONDITION DETECTION

The graphic below show the flow diagram of how the classification could be performed by combining the passive and active measurements.
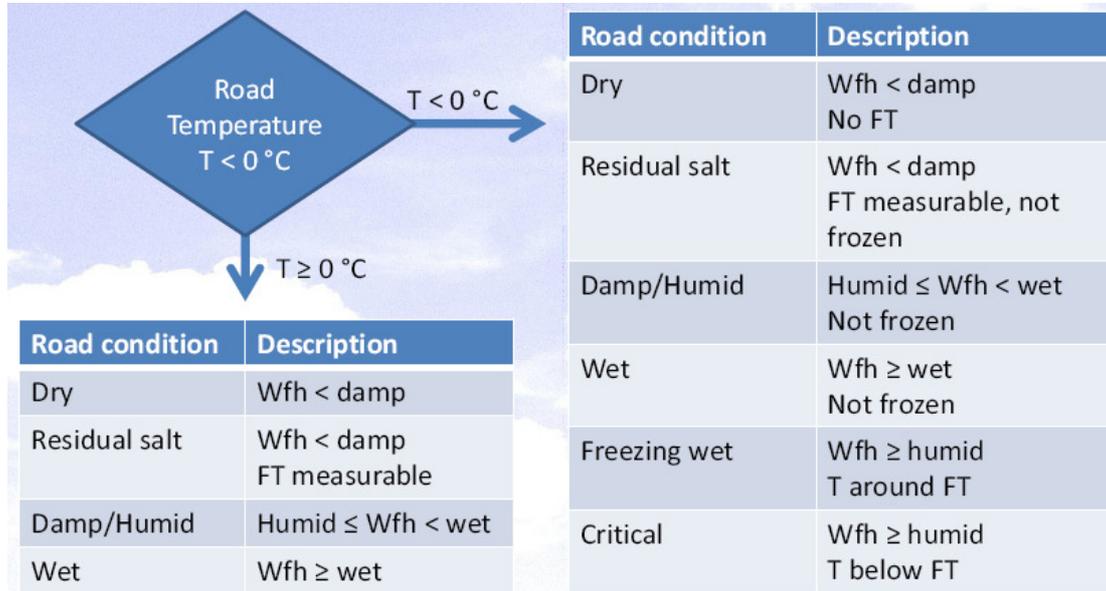

Figure 3: Road condition determination
Wfh = Waterfilm-height, FT = Freeze Temperature, T = Road Surface Temperature