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Skid Resistance Measurement, Evolution and Predictive Laboratory Methods

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The skid resistance of road surfaces generally deteriorates over time due to aggregate surface wear or polishing. Quantifying road surface microtexture (wavelengths shorter than 0.5 mm) and relating it to surface friction helps to better understand mechanisms involved in the evolution of skid resistance. This presentation will discuss three aspects of skid resistance research in New Zealand and in collaboration with IFSTTAR:

1. In-field surface friction measurement devices and correlation to laboratory based prediction methods;
2. Microtextural quantification of skid resistance evolution and accelerated laboratory based polishing devices; and
3. Skid resistance measurement for future transport systems.

In New Zealand, routine skid resistance monitoring of state highways is undertaken annually using the Sideways Force Coefficient Routine Investigation Machine (SCRIM) device, which reports the skid resistance measured as the Sideways Force Coefficient (SFC). Previous research in NZ and internationally has shown that aggregate polishing varies significantly by aggregate source geology. Historical annual surface condition data was extracted to obtain in-field evolution relationships of a number of road sections in various regions that were constructed using three geologically sourced natural aggregates; one Greywacke, one Basalt and one Andesite.

The skid resistance performance of surface aggregates can be assessed in the laboratory by using a polishing device that is designed to simulate traffic polishing actions coupled with a skid resistance measuring device. A number of laboratory tests have been developed to predict the long term in-field skid resistance of road surfaces. The standard laboratory test has historically been the Polished Stone Value (PSV) test as specified in BS EN 1097-8:2009. This method has traditionally been the main tool to assess the long term skid resistance performance of road surfaces. However, a number of researchers have in recent years questioned the reliability of the PSV test results. As technologies have advanced and traffic volume and composition on roads have changed, other devices and methodologies have been developed in an attempt to better assess the skid resistance performance of surface aggregates.

Two alternative laboratory test methodologies that have been developed, are the Wehner/Schulze (WS) device and the Auckland Pavement Polishing Device (APPD) based on a modified version of a US NCAT device, which are both used in conjunction with the Dynamic Friction Tester (DFT).

Previous research has shown that the WS test results can reflect in-field skid resistance evolution both on French national highways / aggregates and on NZ aggregate surfaces. However the WS is not a feasible laboratory device for many road controlling authorities nor industry testing laboratories due to the initial expense, the lead times for delivery and high operating costs. Therefore, a comparison has been made between the in-field skid resistance and the predicted in-field skid resistance data derived either from WS or APPD laboratory tests (a much more cost effective device). It was found that there

is a good comparison between the two sets of data. Results are discussed in terms of using laboratory tests to predict in-field performance.

In the second aspect of this paper, the analysis of three-dimensional images of aggregate samples taken periodically during an accelerated polishing test to record the microtexture changes due to polishing, will be presented. Results show that various roughness parameters expressing local shape and curvature of aggregate asperity tips and how various analysis techniques can be used to reasonably explain the surface friction variation. Relevance of the studied roughness parameters is discussed and interpretation in terms of physical change of surface texture is provided.

The final aspect of the presentation will discuss the changes that are occurring in transport and mobility, new vehicle technologies and what this will potentially mean for skid resistance and infrastructure management in the future.

Keywords: Skid resistance, aggregate, polishing, microtextural analysis, PSV, Wehner Schulze, APPD-DFT test, future vehicle technologies.