STATUS OF SIM TECHNOLOGY IN SOUTH AFRICA AND IT'S IMPLEMENTATION IN ACCELERATED PAVEMENT TESTING (APT)

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ABSTRACT

Optimizations of relatively thin (< 50 mm thick) asphalt road surfacing design towards first class user experiences are still an art today. The risk for failure is difficult to assess, therefore unwanted tyre-road interactions on such failed surfaces may lead to dissatisfied road users. Modern pavement design commonly use simple models for tyre-road contact.
The single tyre model is of a simple circular disk shape, with uniform contact stress on multi-layers system. It is popular because of relative mathematical simplicity and speed of solution, especially when number of layers is limited (< 10 multi-layers). Relatively thin asphalt surfacing is still regarded as a functional layer, designed and built by experienced designers and contractors.

Field data (52 895 truck tyres in South Africa) from the **Stress-In-Motion (SIM) device** indicated that only 10 percent of tyre-road contact patches are of circular shape, 66 percent single rectangular, and 24 percent triple-rectangular shape. This information points toward the need for improved engineering design of thin surfacings, with focus on optimization and longevity. Tyre-road pavement contact research with the SIM and associated analysis have led to improved closed-form multi-layer analysis optimized for speed and shape. Analysis and report ready plots within minutes.
In this paper, improved multi-layered analysis incorporating an option to divide a tyre up to three rectangular shapes – not necessarily with equal vertical contact stress, in addition to the normal circular shape with uniform contact stress is demonstrated. The software was developed for Mechanistic Empirical Cross-Anisotropic Analysis of Multi-layered Elastic Systems (*me*CRAMES) considering cross-anisotropy – material stiffness in horizontal and vertical direction different for any layer owing to compaction forces during construction, with single/multiple circular and/or rectangular tyre loading shapes. The analyses indicated potential failure zones in-side these thin asphalt surfacings which are highly depended on tyre–road contact shapes, as well as layer cross-anisotropy – which need to be incorporated during pavement design, as well as evaluation with Accelerated Pavement Testing (APT) technology.
Key words (3): Tyre-Road-Surface Interaction, Rectangular shape, non-uniformity.