

Heavy vehicle tire measurements in their natural environment

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Abstract

In northern countries, driving conditions vary significantly depending on the seasons. Especially on the start and the end of winter, the driver might encounter dry asphalt, wet asphalt, slosh, snow, hard packed snow, and ice on the same day or even in the same driving journey. The driving conditions have a great effect on the flow of traffic and can cause major disturbances to it. While they are constantly changing, the tire needs to perform well enough to support the driver and prevent said disturbances and ensure the traffic flow.

Usually with tire measurements, great focus has been on measuring the performance of different tires of a vehicle on a very specific and carefully prepared driving surface. For example, these measurements can be sweeping the steering angle of a heavy commercial vehicle tire with some vertical load and forward speed on polished ice and measuring the lateral force generated against the slip angle of the tire. This is important and justified for tire development since the tire tends to be a rather complex and non-linear thing. However, when it comes to traffic, the differences between the performance of different tires of a vehicle in the same driving condition can be small in comparison with the differences between the performance of a tire on different driving conditions.

Focusing only on tire measurements made on a very specific and carefully prepared driving surface can lead to some potential problems and leave something to be desired with the measurements. A major problem can be that we might make decisions concerning tires based on measurements on an irrelevant driving surface that doesn't reflect the actual road conditions, but we still assume it does. With tire measurements it is usually of interest to imitate road condition as close as possible, but road condition is very dynamic and constantly changing, so replicating the conditions artificially is rather challenging.

To get a better understanding on how various driving conditions and road surfaces affect tire performance, a mobile tire force measurement trailer has been developed. The trailer can be brought to locations that can be reached with a typical long combination vehicle that consists of a truck and a full trailer. In more static environment, like asphalt testing, the trailer is robust enough for conducting reliably repeatable measurements with limited runs saving the tire. In a more dynamic setting, like a snowy road, it is possible to focus on getting results from multiple tests that can be completed in short amount of time, since outdoor conditions and softer driving surfaces vary significantly even in a controlled environment.

With the opportunity of conducting tire measurements on test tracks and actual road surfaces in different seasons it is possible to have more comprehensive understanding, on how tires, vehicles and drivers perform and get by in a very wide variety of driving conditions. This is of high importance when developing new driver aid systems as well as autonomous driving. For both, correctly identifying the road condition and knowing how the tire works on it is of utmost importance when ensuring the traffic safety and flow. Ultimately, with advances in autonomous driving and sensor systems, the tire is still the component that is in contact with the road.

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