

Transmitted by the expert
from ISO/TC31/WG6 on Tyre Rolling Resistance

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**COMMENTS FROM ISO/TC 31/WG 6 ON INFORMAL DOCUMENT N° GRB-50-07 PART D on
Annex 6 of R117, Test procedure for measuring Rolling Resistance.**

Part D deals with Annex 6, test procedure for measuring rolling resistance. It proposes the addition of the following sentence to Paragraph 1, Note 2:

1.1.1. "The measurement of distance-time function and using in data processing second derivation of this function is preferable".

1.1.2.

A justification is proposed with two main arguments, one on the existing measurement methods and one on the proposed new measurement method.

This paper proposes answers to both these arguments.

1.1.3. A. *First part of Justification provided to support Part D:*
"It is clear that the methods set in Regulation No.117 are not equivalent, so it is not indifferent, which method reference machine uses."

ISO/TC31/WG6 experts do not share this opinion. The method set in Regulation 117 was directly derived from the standard ISO 28580.

The aim of this standard is to measure the force acting at the tyre/drum interface.

As this force cannot be measured directly, four measurement techniques are allowed to determine it:

1. Measurement of the reaction force at the tyre spindle.
2. Measurement of the torque input at the test drum.
3. Measurement of deceleration of the test drum and tyre assembly.
4. Measurement of the power input to the test drum.

The results of these measurements are then processed to determine the force acting at the tyre/drum interface.

The measurements and interpretations are all based on valid physical principles.

From ISO/TC31/WG6 experts' experience and experimental comparisons, these four ways of determining tyre rolling resistance are equally valid.

Finally, no public document known to the experts of ISO/TC31/WG6 demonstrates the contrary.

1.1.4.

1.1.5.

1.1.6. *B. Second part of Justification provided to support Part D:*

1.1.7. "This new method may expand the ability to choose a standard effective method for tyre rolling resistance determination."

ISO/TC31/WG6 experts do not share this opinion.

This method, as described in ISO DIS 18164 Amdt 1, uses a deceleration measurement technique.

Its specificities lie in:

- A very low sampling rate (1 time measurement per drum or tyre revolution, versus several thousands in usual deceleration technique).
- A very large evolution of speeds to compensate the low sampling rate.
- A specific semi-analytic data interpretation method.
- The fact it may be applied to tyre testing drum machines not specifically designed to measure rolling resistance.

The specific data interpretation method is not based on classic numerical second derivation of distance-time measurement results but on the assumption of a force-speed relation model which, combined with the application of the law of mechanics, leads to an implicit system of two equations to be solved.

No specification is made on the way to solve this system and it was assumed it has to be done numerically.

This method was evaluated by an expert from ISO/TC31/WG6 through real measurements and tentative resolution of the implicit system of equations. Correct solutions for tyre rolling resistance could not be found from this method, through the use of commonly accessible resolution tools, for two main reasons:

- The equation system is based on periodic functions (cosine) and leads to multiple possible solutions. Nothing is given in the method to define which solution should be chosen.
- None of the possible solutions found has the correct order of magnitude for tyre RR and can be considered as valid.

On the other hand, a classic numerical resolution method (second derivation of distance-time measurement results) of the experimental data was adapted to the very low sampling rate used here, and lead to acceptable orders of magnitude, which shows the problem comes from proposed data interpretation process.

The measurement method was applied to the same tyre on a machine specifically designed to measure rolling resistance and on another machine.

The classical method of data interpretation was used, because of the reasons explained above, and showed that the reproducibility of measurement is much decreased when compared to the usual deceleration measurement technique applied on the machine designed to measure rolling resistance.

In consequence, the position of the experts of ISO/TC31/WG6 is that the proposals made in Informal Document GRB-50-07 part D should not be adopted in UN/ECE R117.

