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MOTORCYCLE BRAKING

Harmonization of motorcycle braking requirements

Proposal for draft amendments to Regulation No. 78
(Braking of category L vehicles)

Submitted by the expert from Germany

The text reproduced below was prepared by the expert from Germany to clarify the provisions of the Regulation with regard to high adhesion surface and the Peak Braking Coefficient (PBC). It is mainly based on document ECE/TRANS/WP.29/2006/133 and on informal document No. GRRF-61-03, distributed during the sixty-first GRRF session (see report ECE/TRANS/WP.29/GRRF/61, para. 13).

The modifications to the above-mentioned documents are marked in **bold** characters or as strikethrough.

A. PROPOSAL

Annex 3

Paragraph 1.1.1.(c), amend to read:

- "c) the surface has a ~~nominal~~ peak braking coefficient (PBC) of ≥ 0.8 ~~unless otherwise specified~~.
A surface with a peak braking coefficient (PBC) lower than 0.8 may be used in the case, if rear wheel lift occurs."

Paragraph 1.1.3.(b), amend to read:

- "(b) the method specified in **Appendix 1 to this annex.**"

Add a new Appendix 1, to read:

"Annex 3 - Appendix 1

ALTERNATIVE METHOD FOR THE DETERMINATION OF
PEAK BRAKING COEFFICIENT (PBC)
(see paragraph 1.1.3. to this annex)

1.1. General:

- (a) The test is to establish a PBC for the vehicle type when being braked on the test surfaces described in Annex 3, paragraphs 1.1.1. and 1.1.2.
- (b) The test comprises a number of stops with varying brake control forces. Both wheels shall be braked simultaneously up to the point reached before wheel lock, in order to achieve the maximum vehicle deceleration rate on the given test surface.
- (c) The maximum vehicle deceleration rate is the highest value recorded during all the test stops.
- (d) The Peak Braking Coefficient (PBC) is calculated from the test stop that generates the maximum vehicle deceleration rate, as follows:

$$PBC = \frac{0.566}{t}$$

Where:

t = time taken for the vehicle speed to reduce from 40 km/h to 20 km/h in seconds.

Note: For vehicles unable to achieve a test speed of 50 km/h, PBC shall be measured as follows:

$$PBC = \frac{0.566}{t}$$

Where:

t = time taken, in seconds, for the speed of the vehicle to reduce from $0.8 V_{max}$ to $(0.8 V_{max} - 20)$, where V_{max} is measured in km/h.

- (e) The value of k shall be rounded to three decimal places.

1.2. Vehicle condition:

- (a) The test is applicable to vehicle categories L1 and L3.
(b) ~~ABS disconnected~~**The anti-lock system shall be disconnected, or inoperative, between 40 km/h and 20 km/h.**
(c) Lightly loaded.
(d) Engine disconnected.

1.3. Test conditions and procedure:

- (a) Initial brake temperature: ≥ 55 °C and ≤ 100 °C.
(b) Test speed: 60 km/h or $0.9 V_{max}$, whichever is lower.
(c) Brake application:
Simultaneous actuation of both service brake system controls, if so equipped, or of the single service brake system control in the case of a service brake system that operates on all wheels.
~~For vehicles equipped with a single service brake system control, it may be necessary to modify the brake system if one of the wheels is not approaching maximum deceleration.~~
(d) Brake actuation force:
The control force that achieves the maximum vehicle deceleration rate as defined in paragraph 1.1.(c).
~~The application of the control force must be constant during braking.~~
(e) Number of stops: until the vehicle meets its maximum deceleration rate.
(f) For each stop, accelerate the vehicle to the test speed and then actuate the brake control(s) under the conditions specified in this paragraph."

B. JUSTIFICATION

Annex 3, high adhesion surface:

Ad para. 1.1.1.(c):

On some motorcycles, rear wheel lift occurs when braking on a high adhesion surface of 0.9 PBC. In addition, on such a high friction surface ABS, cycling may not be attainable for certain motor bikes due to the load transfer and available braking force.

Note: During the special GRRF session on 19th June 2006, the expert from the Netherlands reported that they were not able to carry out their ABS tests on the prescribed 0.9 adhesion surface when they participated in the testing programme of the working group on the development of the global technical regulation on motorcycle braking.

Germany had discussed the above-mentioned requirement in 2006 with three motorcycle ABS manufacturers. All manufacturers confirmed that during the ABS tests with some motorcycles on such a high adhesion surface, rear wheel lift occurred and the prescribed ABS tests could not be carried out. Therefore, it is proposed to lower the definition of the high adhesion surface.

In addition, it is more reasonable for the nominal peak braking coefficient to lay down a minimum (≥ 0.8) rather than a concrete fixed value (0.9). It is unlikely that the high adhesion surfaces of the different proving grounds have an exact PBC value of 0.9. Since the peak braking coefficient depends largely on the actual tyre fitted on the motorcycles, a fixed PBC value of 0.9 would exclude the testing of other tyres with a different tyre to road adhesion characteristics.

With the above proposed amendment, the words "unless otherwise specified" can be deleted in paragraph 1.1.1., because this definition is now in line with the definition of the high friction surface of paragraph 9.7.1.(a) of Annex 3 (see ECE/TRANS/WP.29/2006/133). In UNECE Regulation No. 13 the word "nominal" has the meaning of a defined specific value (not an approximate value). The meaning of the word "nominal" in paragraph 1.1.1. is ambiguous and unnecessary, and should therefore be deleted to avoid different and needless interpretations.

New Appendix 1 to Annex 3 for the determination of PBC:

Ad para. 1.1.:

With the 07 series of amendments (as of 18.09.1994), the old formulae $PBC = \frac{0.56}{t}$ in UNECE

Regulation No. 13 was changed to $PBC = \frac{0.566}{t}$ since the old formulae was too inaccurate.

This amendment should not miss the opportunity to take account of the state of art and amend a formula which was formulated about 20 years ago when ABS testing was still in its infancy. The accuracy of three decimal places for the PBC value is required by Regulation No. 13, thus the same procedure should be applicable to Regulation No. 78 as well.

Ad para. 1.2.:

With the 07 series of amendments of Regulation No. 13 (as of 18.09.1994) the old requirement that the "ABS shall be disconnected" was replaced by the above proposed requirement 1.2.b. With Regulation No. 78 the same amendment should be made. In many cases, it is technically advisable to determine the k-value (PBC value) with the assistance of the ABS. To prohibit the use of the ABS outside the speed range between 40 km/h and 20 km/h is technically contra productive and may lead to the situation that only a poor determination of the k-value is possible.

Ad para. 1.3.:

The sentence: "For vehicles equipped with a single service brake system control, it may be necessary to modify the brake system if one of the wheels is not approaching maximum deceleration." is unrealistic and should be deleted. The only possibility to achieve maximum

deceleration is to modify the brake distribution between the front and rear axle. However, in that case the design of the brake system has changed.

The Peak Braking Coefficient (PBC) is by definition the quotient of the maximum braking forces without locking the wheels and the corresponding dynamic load on the axle being braked. To comply with this definition, it may sometimes be advisable to adjust the control force to optimize the k-measurement.

Therefore, it is proposed to delete the requirement: "the application of the control force must be constant during braking". It makes no sense to forbid a testing condition which may be technically advisable and which may improve the assessment.
