Transmitted by the expert from IMMA

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agenda item 5(b))

Proposal for an amendment to GTR No. 3 (Motorcycle Brake Systems)

Submitted by the expert from International Motorcycles Manufacturers Association

The text reproduced below was prepared by the expert from IMMA in order to introduce amendments to clarify the text and introduce simplified test procedures in this regulation and align it with UNECE Regulation No. 78. The modifications to the current text of the Regulation are marked in bold or strikethrough characters.

STATEMENT OF TECHNICAL RATIONALE AND JUSTIFICATION

I. OBJECTIVE

1) The objective of this proposal is to recommend the adoption of an amendment to the current global technical regulation (gtr) regarding motorcycle brake systems. At the xxx 2012 session of the Executive Committee (AC.3), Contracting Parties to the 1998 Global Agreement, under the World Forum for Harmonization of Vehicle Regulations (WP.29), xxxxxxx establishing a gtr on Motorcycle Brake Systems (gtr No. 3).

2) This amendment is necessary to clarify and align the provisions of gtr No. 3 with those of UNECE Regulation No. 78.

II. JUSTIFICATION

3) In previous regulations for the PBC measurements, the K-method was directly referenced but later a proposal was made to transfer the details in R78 as currently included in Appendix 1 to Annex 3. The amendment proposes to directly reference the ASTM method used for the purposes of PBC measurement.

4) For PBC measurements reference was made to the ASTM method but it was considered useful to have all the factors in paragraph 5 to allow for clarity and reference especially as the referenced document is updated. The physical factors like measuring principle which affect the measuring data and precision are continued from ASTM E 1337-90 where as other factors which restrict the test method are not adopted or changed.

5) For the alternative method for determining the PBC (peak brake coefficient) the text from Appendix 1 of Annex 3 of R78 has been introduced in paragraph 6 to allow for clarity and reference especially as the referenced document is updated.

6) Concern had been raised at the possible confusion of the regulation caused by the interpretation of the terms “inoperative” and “disconnected”. For the disconnected-method the brake-line pressure is the maximum braking pressure just before wheel-locking (higher pressure than ABS operating start) where as for the inoperative-method the brake-line pressure is lower than ABS operating start, so braking pressure during K-measurement can be adjusted only lower range than ABS operating.

This amendment clarifies the situation by deleting both the terms and using the term “inoperable”. The dictionary definition for “inoperable” is “incapable of being implemented or operated; unworkable”.

7) The simplified ASTM test method in Appendix 2 to Annex 3 allows the use of the ASTM Method without the trailer but other equivalent equipment. Measurement by a towed trailer method has some defect in that the movement can be unstable on a low μ friction surface where as a vehicle type measurement method can get a more stable result. For the purpose of this simplified test method a representative vehicle is defined to avoid the type approval authorities needing extensive tests to measure the PBC.

8) Clarification of cross-references to ensure correct test is used for the right category of vehicles.

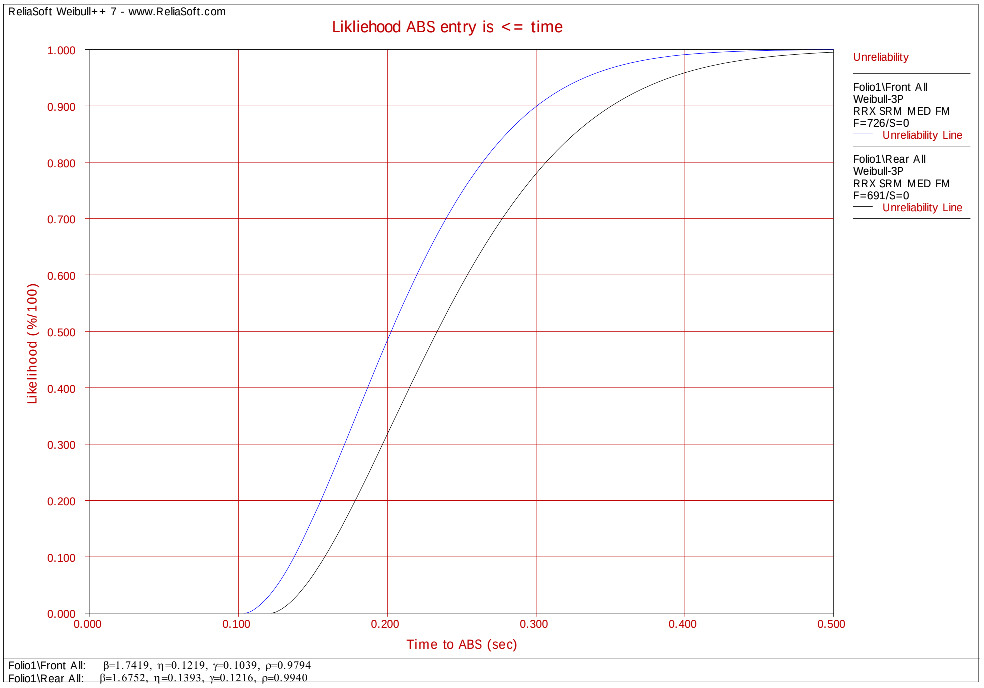
9) Clarification is given on what should be considered as a representative vehicle.

10) The clarification of “Fully cycling” ensures that brake force modulates repeatedly or continuously during ABS braking. This allows for a wider range of modulations, not limited to the traditional ABS cycles. The term “cycle fully” has been replaced by “fully cycling” in the text for sake of consistency.

“The force applied is that which is necessary to ensure that the ABS will ~~cycle fully~~ **be fully cycling** throughout each stop, down to 10 km/h.”

11) This amendment aligns R78 and GTR 3 with respect to the simple test method and also updates the use of SI units and change in decimal points.

12) It has been noticed in testing that the brake application rate specified in section 4.9.5.1 can result in a large number of test failures. If can be seen in the chart below that the 0.2 second lower limit shows a failure rate is between 30% and 50% of the time.



By reducing the lower limit to 0.1 seconds the test failure rate reduces to practically zero. Allowing the reduction tends to make the regulation more stringent by including a greater number of brake force application rates and eliminates restrictive test requirements.

B. Proposal

Contents page:

Add to end of the current contents list, the following references to paragraphs 5 and 6.

5. METHOD FOR THE DETERMINATION OF PEAK BRAKING COEFFICIENT (PBC)

6. ALTERNATIVE METHOD FOR THE DETERMINATION OF PEAK BRAKING COEFFICIENT (PBC)

In the text of the regulation, add or ~~delete~~ the relevant text in the following clauses:

3.1.4. Parking brake system:

If a parking brake system is fitted, it shall hold the vehicle stationary on the slope prescribed in paragraph ~~4.8.2~~ **4.1.1.4**.

For 3-2, 3-4 and 3-5, the parking brake system shall be tested in accordance with paragraph 4.8.

The parking brake system shall:

(a) have a control which is separate from the service brake system controls; and;

(b) be held in the locked position by solely mechanical means.

Vehicles shall have configurations that enable a rider to be able to actuate the parking brake system while seated in the normal driving position.

4.1.1.3 Measurement of PBC

The PBC is measured ~~as specified in national or regional legislation determined by the approval authority~~ using either:

(a) ~~the American Society for Testing and Materials (ASTM) E1136 standard reference test tyre, in accordance with ASTM Method E1337-90, at a speed of 40 mph without water delivery; or~~ **The method specified in paragraph 5.**

PBC measurement of the surface shall be carried out at least once a year. PBC measurement shall be completed prior to testing if any major maintenance or alterations that may significantly modify the PBC have occurred since the last measurement

(b) the method specified in the ~~appendix to Annex 4~~ **paragraph 6** ~~of UNECE Regulation No. 78, 01 series of amendments~~

Note: An alternative vehicle may be acceptable for PBC measurement by method (b) if that vehicle has shown the same nominal PBC on both high μ and low μ as previously determined by method (a). PBC measurement of the surface shall be carried out at the same frequency as undertaken in method (a).

4.1.1.4. Parking brake system tests:

The specified test slope ~~has~~ **shall have a test surface gradient of 18 per cent and shall have** a clean and dry surface that does not deform under the weight of the vehicle.

4.9. ABS tests

4.9.1. General:

(a) The tests are only applicable to the ABS fitted on vehicle categories 3-1 and 3-3.

(b) The tests are to confirm the performance of brake systems equipped with ABS and their performance in the event of ABS electrical failure.

(c) "Fully cycling" means that the anti-lock system is repeatedly **or continuously** modulating the brake force to prevent the directly controlled wheels from locking.

4.9.3. Stops on a high friction surface

4.9.3.1. Test conditions and procedure:

(d) Brake actuation force:
The force applied is that which is necessary to ensure that the ABS will ~~cycle fully~~ **be fully cycling** throughout each stop, down to 10 km/h.

4.9.5. Wheel lock checks on high and low friction surfaces:

4.9.5.1. Test conditions and procedure:

(e) Brake actuation force:
The force applied is that which is necessary to ensure that the ABS will ~~cycle fully~~ **be fully cycling** throughout each stop, down to 10 km/h.

(f) Brake application rate:

The brake control actuation force is applied in **0.1** – 0.5 seconds.

4.9.6. Wheel lock check - high to low friction surface transition

4.9.6.1. Test conditions and procedure:

(e) Brake actuation force:
The force applied is that which is necessary to ensure that the ABS will ~~cycle fully~~ **be fully cycling** throughout each stop, down to 10 km/h.

4.9.7. Wheel lock check - low to high friction surface transition

4.9.7.1. Test conditions and procedure:

(e) Brake actuation force:
The force applied is that which is necessary to ensure that the ABS will ~~cycle fully~~ **be fully cycling** throughout each stop, down to 10 km/h.

Insert new clauses 5 and 6.

5. METHOD FOR THE DETERMINATION OF PEAK BRAKING COEFFICIENT (PBC)

5.1 General

(a) **The test is to establish a PBC of the test surface described in paragraphs 4.1.1.1. and 4.1.1.2.**

(b) **ASTM E 1136 should be used as a measuring tire.**

(c) **The test comprises a number of braking increasingly to a measuring tire installed to a measuring vehicle which is running by constant designated measuring speed.**

In each measurement braking actuation force should be enough to reach to the maximum braking force for the measuring tire on the tested surface.

The designated measuring speed for the test surface described in Annex 3, paragraph 1.1.1 (High friction surface) and paragraph 1.1.2 (Low friction surface) shall be 64 km/h.

(d) **The maximum braking force in each measurement is the highest value in the each measurement.**

(e) **The Peak Braking Coefficient (PBC) is calculated from the values of the maximum braking force, as follows:**

$PBC_n = B_n/V_n$

where:

PBC_n **= the value of PBC for each braking**

B_n **= the maximum braking force for each braking**

V_n **= vertical load at the test wheel when braking force is the maximum**

(f) **The PBC of the test surface is calculated by averaging PBC values from each braking**

$$PBC = (PBC_1 + PBC_2 + \cdots + PBC_n) / n$$

where:

n **= total measurement number; should be at least 8 to get a stable result**

(g) **The value of PBC shall be rounded to two decimal places.**

5.2 Test apparatus condition:

(a) **The wheel shall have a suspension capable of holding toe and camber changes to within ±0.05 with maximum vertical suspension displacement under both static and dynamic conditions.**

(b) **The test tire shall be provided a static load of 4586 ± 67 N.**

(c) **The test tire shall be the standard reference test tire (SRTT), as Specification E1136, mounted on a suitable 14 by 5.5-inch rim.**

The test tire inflation pressure shall be 241±3 kPa.

When irregular wear or damage results from tests, or when wear or usage influences the test results, the use of the tire should be discontinued.

(d) **When measuring on wet test surface, offset the test wheel sufficiently or deliver water just before a measurement wheel to prevent "tracking" of the forward wheel.**

5.3 Test conditions and procedure

(a) Install an SRTT (Specification E 1136) in the test position of the vehicle.

(b) Check and, if necessary, adjust the static load on the test tire.

(c) Check and adjust tire inflation pressure as required immediately before testing to specified value.

(d) Perform pretest tire conditioning on a dry and level surface if using new tire. Tire shall be chirped ten times at 32 km/h under test load. If necessary, additional tire conditioning should be undertaken.

(e) Conduct test at the required test vehicle speed. Maintain test speeds within ±1.6km/h. It is recommended that peak braking coefficient measurement tests be conducted using the chirp-test methodology to minimize tire damage due to tire sliding.

Chirp-test refers to the progressive application of brake torque required to produce the maximum value of longitudinal braking force that will occur prior to wheel lockup, with subsequent brake release to prevent any wheel lockup (tire slide).

(f) Brake is progressively applied until sufficient braking torque results to produce the maximum braking force that will occur prior to wheel lockup. Longitudinal force, vertical load, and vehicle speed are recorded.

Time to peak longitudinal force for high μ between 0.2 and 0.5 sec, for low μ for it may be necessary to use longer time to peak longitudinal force.

(g) It is recommended to refer to ASTM E 1337 for data sampling rate and data calculation method.

But data sampling rate shall be at least 100 Hz, and additional data points if required.

6. ALTERNATIVE METHOD FOR THE DETERMINATION OF PEAK BRAKING COEFFICIENT (PBC)

6.1. General

(a) The test is to establish a PBC for the vehicle type when being braked on the test surfaces described in paragraphs 4.1.1.1. and 4.1.1.2.

(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 Vmax to (0.8 Vmax - 20), where Vmax is measured in km/h.

(e) The value of PBC shall be rounded to two decimal places.

6.2. Vehicle condition

(a) The test is applicable to vehicle categories L1 and L3.

(b) The anti-lock system shall be inoperable between 40 km/h and 20 km/h.

(c) Lightly loaded.

(d) Engine disconnected.

6.3. Test conditions and procedure

(a) Initial brake temperature: ≥ 55 °C and ≤ 100 °C.

(b) Test speed: 60 km/h or 0.9 Vmax, 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 6.1. (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.
