Transmitted by the expert from IMMA

Informal document **GRRF-74-36**
(74th GRRF, 19-22 February 2013,
agenda item 5(b))

Proposal for Amendment to gtr 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 R78. 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.

Proposals

1. Proposal

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.

---

* In accordance with the programme of work of the Inland Transport Committee for 2006–2010 (ECE/TRANS/166/Add.1, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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.

B. Justification

1) Currently in paragraph 3.1.4 Parking brake system following is described.
" If a parking brake system is fitted, it shall hold the vehicle stationary on the slope prescribed in paragraph 4.8.2.."

And in "paragraph 4.8."

" 4.8. Parking brake system test – for vehicles equipped with parking brake

4.8.1. Vehicle condition:

(a) The test is applicable to vehicle categories 3-2. 3-4 and 3-5;

(b) Laden;

(c) Engine disconnected.

4.8.2. Test conditions and procedure:

(a) ----------

(b) ----------"

Because " in paragraph 4.8.2. " is described in paragraph 3.1.4. , it can be jumped from paragraph 3.1.4. to paragraph 4.8.2..

In this case objective category described in paragraph 4.8.1. for parking brake test can be ignored, and it can be possible to misunderstand that category 3-1 and 3-3 are also objected for parking brake test.

This proposal is to prevent this misunderstanding.

Also in paragraph 5.2.6. Parking brake system test in " STATEMENT OF TECHNICAL RATIONALE AND JUSTIFICATION " of GTR3, following is described.

5.2.6. Parking brake system test

The purpose of the parking brake system requirement in the motorcycle brake systems gtr is to ensure that 3-wheeled motorcycles can remain stationary without rolling away when parked on an incline.

2) Slope prescription in paragraph 4.1.1.4.of Annex 3 is not enough for gradient.

---

2. Proposal

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

Insert new clause 5.

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-in. 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.

B. Justification

1. In previous GTR for the PBC measurements, the K-method was referenced by referring to Appendix 1 to Annex 3 of R78. Historically there had been a direct reference in R78 until a proposal was made to transfer the details of the K-method to R78. The reference to the ASTM method too had been by direct reference. This amendment proposes now to directly transfer the relevant details from the previously referenced ASTM method for PBC measurement.

2. The direct transfer of the relevant details from the previously referenced ASTM method for PBC measurement was considered useful for all the factors to be 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.

3. The simplified test method in this proposal allows the use of the ASTM Method without the trailer but other equivalent equipment. Type approval authorities and industry have experienced that PBC measurement on a low μ friction surface by a towed trailer method has some defects in that the movement can be unstable whereas with the use of equivalent equipment such as a vehicle type measurement method can get a more stable result

   ASTM E 1337-90 is one of the simplified ASTM test method in paragraph 5.

4. On the proposal to amend the frequency of PBC measurement is based upon the current text from Appendix 4 to Annex 6 of Regulation R13H which states "The calibration of the surface has to be carried out at least once a year with a representative vehicle to verify the stability of R"

Transmitted by the expert from IMMA

Informal document **GRRF-74-36**
(74th GRRF, 19-22 February 2013,
agenda item 5(b))

3. Proposal

4.1.1.3 Measurement of PBC

(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 friction surface and low friction surface as previously determined by method (a).

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

Insert new clause 6.

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 3-1 and 3-3.

(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.

B. Justification

1) In previous regulations for the PBC measurements, the "K-method" was directly referenced to R78. The amendment proposes to directly reference the "K-method"

2) PBC test is not for the vehicle. This is for the test surface. In method (a) always same specification tire should be used. On the point of view for control of test surface, using same vehicle which means same specification tire for PBC test is more appropriate.

   Also it may happen the following when doing by the unsuitable vehicle .

   - Some possibility of rear wheel lift by maximum braking causing PBC test impossible.
   - Some possibility that the vehicle not getting into the wheel lock, because of lacking brake performance (brake lever stroke reaches full stroke before wheel locking).

3) In 6.2 b) 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".

4) The level of accuracy is not necessary as all the other values are given to 2 decimal places. ASTM Method also 2 decimal places.

---

4. Proposal

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.

B. Justification

5) The clarification of the term "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.

---

5. Proposal

4.9. ABS tests

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.

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.

B. Justification

1) For consistency the term “cycle fully” has been replaced by “fully cycling” which is defined paragraph 9.1 to this annex. The definition has been clarified so that it now allows for a wider range of modulations and is not limited to the traditional ABS cycles. .

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

---

6. Proposal

4.9. ABS tests

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

(f) Brake application rate:

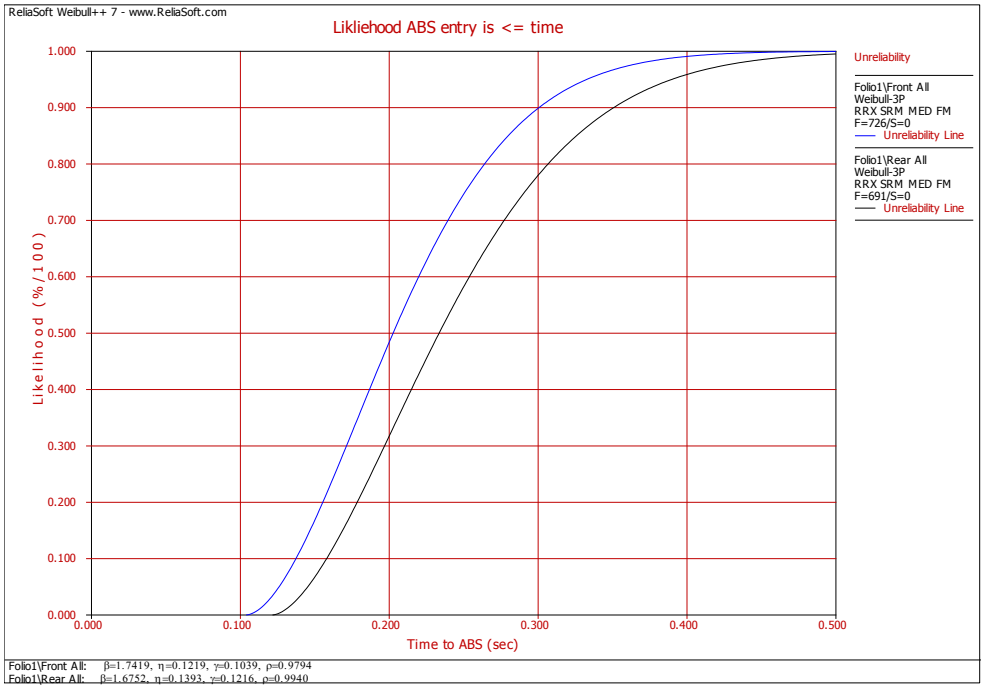
The brake control actuation force is applied in **0.1** – 0.5 seconds.

B. Justification

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.

Transmitted by the expert from IMMA

Informal document **GRRF-74-36**
(74th GRRF, 19-22 February 2013,
agenda item 5(b))



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.