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Item 5(a) of the provisional agenda

Motorcycle braking – Regulation No. 78

Proposal for amendments to Regulations No. 78 (Uniform provisions concerning the approval of vehicles of categories L₁, L₂, L₃, L₄ and L₅ with regard to braking)

Submitted by the expert from the International Motorcycles Manufacturers Association*

The text reproduced below was prepared by the experts from the International Motorcycles Manufacturers Association (IMMA) in order to introduce amendments to clarify the text of the Regulation. The modifications to the current text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106, ECE/TRANS/2010/8, 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.

I. Proposal

Paragraph 5., amend to read:

"5. **Specifications**

5.1. Brake system requirement

...

5.1.4. Parking brake system

If a parking brake system is fitted, it shall hold the vehicle stationary on the slope prescribed in ~~paragraph 8.2. of Annex 3~~ **1.1.4 Annex 3.**

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.

For L₂, L₄ and L₅, the parking brake system shall be tested in accordance with paragraph 8 of Annex 3."

Annex 3

Paragraphs 1. to 1.1.4., amend to read:

"1. General

1.1. Test surface

...

1.1.3. Measurement of PBC

The PBC is measured ~~as 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
- (b) The method specified in Appendix 1 to this ~~annex~~ **Annex.**

Note: A representative 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.

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 mass of the vehicle."

Paragraphs 9. to 9.7.1., amend to read:

"9. ABS tests

9.1. General:

- (a) The tests are only applicable to the ABS fitted on vehicle categories L₁ and L₃;
- (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.

...

9.3. Stops on a high friction surface:

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.

...

9.5. Wheel lock checks on high and low friction surface

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 ~~0.2~~ **0.1** – 0.5 secs.

...

9.6. Wheel lock check - high to low friction surface transition:

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.

...

9.7. Wheel lock check - low to high friction surface transition:

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.

..."

Annex 3, Appendix 1, paragraphs 1.1. and 1.2., amend to read:

"1.1. General

...

- (e) The value of PBC shall be rounded to ~~three~~ **two** decimal places.

1.2. Vehicle condition:

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

II. Justifications

A. Justification 1

Paragraph 5.1.4 Parking brake system:

Paragraph 1.1.4 of Annex 3, Parking brake system tests:

- (a) Currently in paragraph 5.1.4 Parking Brake System is described as.

"If a parking brake system is fitted, it shall hold the vehicle stationary on the slope prescribed in paragraph 8.2."

And in "paragraph 8 in Annex 3"

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

8.1. Vehicle condition:

- (a) The test is applicable to vehicle categories 3-2, 3-4 and 3-5;
- (b) Laden;
- (c) Engine disconnected.

8.2. Test conditions and procedure:

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

Because "in paragraph 8.2 of Annex 3" is described in paragraph 8.1.4., it can be jumped from paragraph 5.1.4 to paragraph 8.2 of Annex 3.

In this case objective category described in paragraph 8.1. for parking brake test can be ignored, and it can be also misunderstood that category 3-1 and 3-3 are also objected for parking brake test.

This proposal is to prevent this misunderstanding.

In paragraph 5.2.6., the Parking Brake System test defined in the "Statement of technical rationale and justification" section of UN GTR3, is described as follow:

"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."

- (b) Slope prescription in paragraph 8.2 (b) of Annex 3 is not enough for gradient.

B. Justification 2

Annex 3. Test conditions, procedures and performance requirements

Paragraph 1.1.3 Measurement of PBC

- (a) Currently in 1.1.General in 4.1.1.3 the following is described.

"(a) The test is to establish a PBC for the vehicle type when being braked on the test surfaces described in 1.1.1 and 1.1.2 of Annex 3."

The terms "for the vehicle type" imply that the vehicle used for PBC test should only be only the vehicle used for type approval. The PBC test is not testing the vehicle but the test surface. Method (a) (ASTM method) specifies that one specific tire should be used for control of test surface. Using the "same vehicle", which implies the same specific tire, is more appropriate for PBC test.

- (b) In some instances just before the wheel-locking condition for all-wheels during the PBC test, the following may happen to the vehicle for type approval:

"(a) rear wheel lift due to maximum braking may cause difficulties in undertaking the PBC test.

(b) vehicle not getting into the wheel lock, because of reduction in brake performance (brake lever stroke reaches full stroke before wheel locking).

(c) For 3-wheeled motorcycles (L₂, L₄, L₅), the PBC test is not described and it may understood that the PBC test is not possible for these vehicle types for type approvals"

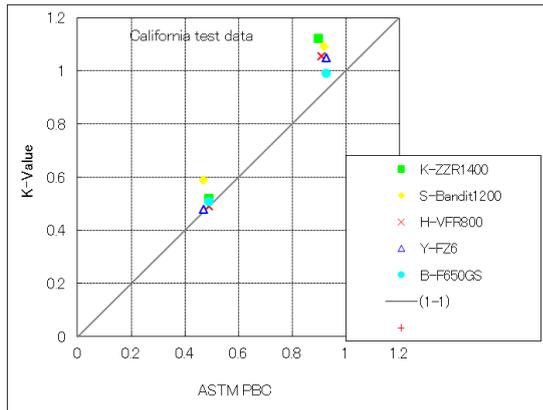
- (c) During GTR3 discussions, a correlation test between K-method and ASTM method had been carried out in California. The data from the test are shown in the graph below.

PBC values by K-method were for same course, and the following were recognized.

- PBC values were different by measuring motorcycle (tyre).
- Such level of difference should be permitted.

It was recognized that even for the same course PBC values were different for each motorcycle. It was noted that it is beneficial to measure the PBC values of the course using the same motorcycle to maintain the course PBC value condition.

The IMMA proposal includes a condition saying that the choice of a motorcycle is subject to the confirmation of the correlation level of the motorcycle for K-method to ASTM method. IMMA believes that a motorcycle with correlation level similar to the one tested in California can be a representative vehicle to be used for measuring PBC values of the course.



(d) Test results by BMW (friction coefficient tyre/road with different motorcycles and the same motorcycle but different tyres) showed on the same track (even on the same day with the same driver) following results:

These results show that different tire (also different motorcycle) makes PBC values of the course different and the differences are not small.

This is the reason why measuring PBC value by a representative vehicle (always same motorcycle, same tire) is useful for maintaining PBC value of the course.

- BMW F800ST (tyre: Continental Sport Attack): 1.1
- BMW 1200 GS HP2 (tyre Michelin Annakee): 1.0
- BMW 1200 GS HP2 (tyre Metzeler Enduro 3): 0.83
- BMW 1200 GS HP2 (tyre Metzeler Karoo): 0.73



BMW F800ST



BMW HP2



Continental Sport Attack



Metzeler Karoo



Metzeler Enduro 3



Michelin Annakee

(e) In UN Regulation No. 13-H, paragraph 2.2. of the Annex6, Appendix4 "METHOD OF SELECTION OF THE LOW ADHESION SURFACE", 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.

A representative vehicle can be used in UN Regulation No. 13-H.

C. Justification 3

Annex 3. Test conditions, procedures and performance requirements.

Paragraph 9. ABS tests

(a) 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.

(b) For consistency the term “cycle fully” has been replaced by “fully cycling” which is defined in 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

D. Justification 4

Annex 3. Test conditions, procedures and performance requirements

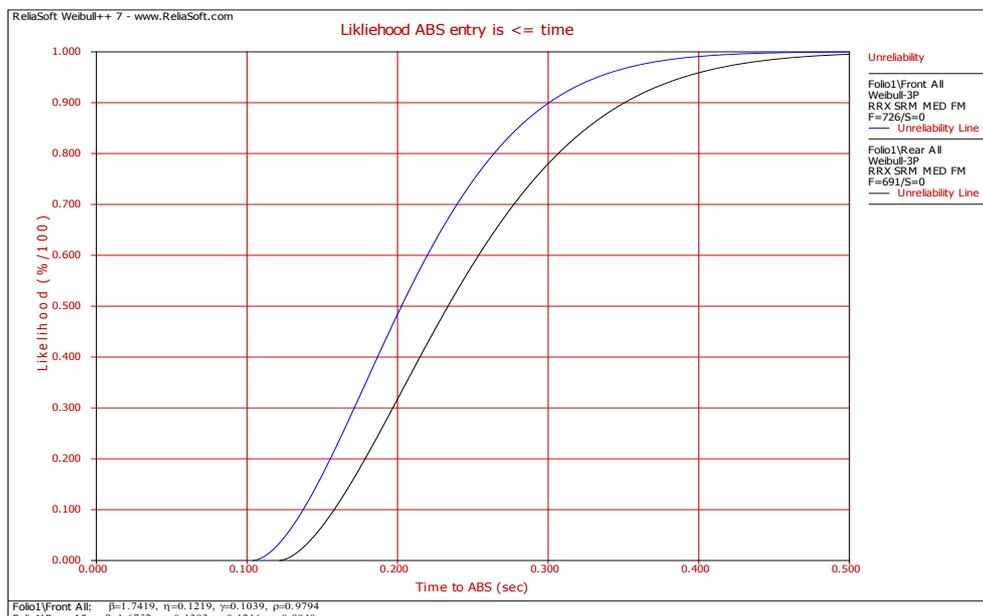
Paragraph 9. ABS tests

"9.5. ...

(f) Brake application rate:

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

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. It can be seen in the chart below that the 0.2 second lower limit shows a failure rate is between 30 per cent and 50 per cent 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.

E. Justification 5

Annex 3. Test conditions, procedures and performance requirements

Appendix 1. Alternative Method for the Determination of Peak Braking Coefficient (PBC)

1.1. e) ...

- 1) The level of accuracy is not necessary as all the other values are given to 2 decimal places.

1.2. Vehicle condition:

- 2) 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 during K-measurement, the braking pressure can be adjusted only to the lower range than ABS operating.

- 3) 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*".
