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### Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

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Item 4.9.5 of the provisional agenda

#### 1958 Agreement:

Consideration of draft amendments to existing

UN Regulations submitted by GRBP

## Proposal for Supplement 10 to the original version of UN Regulation No. 109 (Retreaded tyres for commercial vehicles and their trailers)

### Submitted by the Working Party on Noise and Tyres\*

The text reproduced below was adopted by the Working Party on Noise and Tyres (GRBP) at its seventy-first session (ECE/TRANS/WP.29/GRBP/69, paras. 16 and 17). It is based on ECE/TRANS/WP.29/GRBP/2020/4 and ECE/TRANS/WP.29/GRBP/2020/5. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration at their June 2020 sessions.

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\* In accordance with the programme of work of the Inland Transport Committee for 2020 as outlined in proposed programme budget for 2020 (A/74/6 (part V sect. 20) para 20.37), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.



Paragraph 2.47., amend to read:

- "2.47. "Standard Reference Test Tyre (SRTT)" means a tyre that is produced, controlled and stored in accordance with the American Society for Testing and Materials (ASTM) standards:
- (a) E1136 – 17 for the size P195/75R14 and referred to as "SRTT14";
  - (b) F2872 – 16 for the size 225/75 R 16 C and referred to as "SRTT16C";
  - (c) F2871 - 16 for the size 245/70R19.5 and referred to as "SRTT19.5";
  - (d) F2870 – 16 for the size 315/70R22.5 and referred to as "SRTT22.5."

Paragraph 4.3., amend to read:

- "4.3. At the request of the Type Approval Authority, the Retreader shall submit samples of tyres for test or copies of test reports from the technical services, communicated as given in paragraph 12. of this Regulation."

Paragraph 7.2., amend to read:

- "7.2. In order to be classified as a "snow tyre for use in severe snow conditions", the retreaded tyre to comply with this Regulation shall meet the performance requirements of paragraph 7.2.1. The retreaded tyre size shall meet these requirements based on a test method of Annex 10 by which:
- (a) The mean fully developed deceleration ("mfdd") in a braking test;
  - (b) Or alternatively an average traction force in a traction test;
  - (c) Or alternatively the average acceleration in an acceleration test
- of a candidate tyre is compared to that of a Standard Reference Test Tyre (SRTT).
- The relative performance shall be indicated by a snow grip index."

Paragraph 7.2.1., amend to read:

- "7.2.1. For Class C2 and C3 tyres, the minimum snow grip index value, as calculated in the procedure described in Annex 10 and compared with the respective Standard Reference Test Tyre (SRTT) shall be as follows:

Class of tyre	Snow grip index (brake on snow method) <sup>(a)</sup>	Snow grip index (spin traction method) <sup>(b)</sup>	Snow grip index (acceleration method) <sup>(c)</sup>
	Ref. = SRTT16C	Ref. = SRTT14	Ref. = SRTT19.5, SRTT22.5
C2	1.02	1.10	No
C3	No	No	1.25

Annex 10

Paragraph 3.2.1., amend to read:

- "3.2.1. For every candidate tyre and the standard reference tyre, ABS-braking test runs shall be repeated a minimum of 6 times.
- The zones where ABS-braking is fully applied shall not overlap.
- When a new set of tyres is tested, the runs are performed after shifting aside the vehicle trajectory in order not to brake on the tracks of the previous tyre.
- When it is no longer possible not to overlap full ABS-braking zones, the test course shall be re-groomed.

Required sequence:

6 repeats SRTT, then shift aside to test next tyre on fresh surface;

6 repeats Candidate 1, then shift aside;

6 repeats Candidate 2, then shift aside;

6 repeats SRTT, then shift aside."

*Paragraph 3.4.1.1.*, amend to read:

"3.4.1.1. For each tyre and each braking test, the arithmetic mean  $\bar{a}$  and corrected sample standard deviation  $\sigma_a$  of the mfdd shall be computed and reported.

The coefficient of variation  $CV_a$  of a tyre braking test shall be computed as:

$$CV_a = 100\% \cdot \frac{\sigma_a}{\bar{a}}$$

with

$$\sigma_a = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (a_i - \bar{a})^2}$$

"

*Paragraph 3.4.1.2.*, amend to read:

"3.4.1.2. Weighted averages  $wa_{SRTT}$  of two successive tests of the SRTT shall be computed taking into account the number of candidate tyres in between:

In the case of the order of testing R1 – T – R2, the weighted average of the SRTT to be used in the comparison of the performance of the candidate tyre shall be taken to be:

$$wa_{SRTT} = \frac{1}{2}(\bar{a}_{R1} + \bar{a}_{R2})$$

Where:

$\bar{a}_{Rn}$  is the arithmetic mean of the mfdd for the n-th test of the SRTT.

In the case of the order of testing R1 – T1 – T2 – R2, the weighted averages  $wa_{SRTT}$  of the SRTT to be used in the comparison of the performance of the candidate tyre shall be taken to be:

$wa_{SRTT} = \frac{2}{3}\bar{a}_{R1} + \frac{1}{3}\bar{a}_{R2}$  for comparison with the candidate tyre T1 and

$wa_{SRTT} = \frac{1}{3}\bar{a}_{R1} + \frac{2}{3}\bar{a}_{R2}$  for comparison with the candidate tyre T2."

*Paragraph 3.4.1.3.*, amend to read:

"3.4.1.3. The snow grip index (SG) of a candidate tyre Tn shall be computed as the quotient of the arithmetic mean  $\bar{a}_{Tn}$  of the mfdd of the tyre Tn and the applicable weighted average  $wa_{SRTT}$  of the SRTT:

$$SG(Tn) = \frac{\bar{a}_{Tn}}{wa_{SRTT}}$$

"

*Paragraph 3.4.2.*, amend to read:

"3.4.2. Statistical validations

The sets of repeats of measured or computed mfdd for each tyre should be examined for normality, drift, eventual outliers.

The consistency of the arithmetic means  $\bar{a}$  and corrected sample standard deviations  $\sigma_a$  of successive braking tests of SRTT should be examined.

In addition and in order to take in account possible test evolution, the coefficient of validation  $CVal_a$ (SRTT) is calculated on the basis of the average values of any two consecutive groups of the minimum 6 runs of the Standard Reference Test Tyre according to

$$CVal_a(SRTT) = 100\% \times \left| \frac{\overline{a_{R2}} - \overline{a_{R1}}}{\overline{a_{R1}}} \right|$$

The coefficient of validation  $CVal_a$ (SRTT) shall not differ by more than 5 per cent.

The coefficient of variation  $CV_a$ , as defined in paragraph 3.1.1. of this annex, of any braking test shall be less than 6 per cent.

If those conditions are not met, tests shall be performed again after re-grooming the test course."

*Paragraph 4.1.*, amend to read:

"4.1. (omitted)"

*Paragraph 4.2.*, amend to read:

"4.2. Methods for measuring Snow Grip index (SG)

Snow performance is based on a test method by which the average acceleration in an acceleration test, of a candidate tyre is compared to that of a standard reference tyre.

The relative performance shall be indicated by a snow grip index.

When tested in accordance with the acceleration test in paragraph 4.7. below, the average acceleration of a candidate snow tyre shall be at least 1.25 compared to one of the two equivalent Standard Reference Test Tyres SRTT19.5 and SRTT22.5."

*Paragraph 4.7.*, amend to read:

"4.7. Acceleration on snow test procedure for snow grip index of Class C3."

*Paragraph 4.7.5.4.*, amend to read:

"4.7.5.4. For every candidate tyre and the standard reference tyre, the acceleration test runs shall be repeated a minimum of 6 times and the coefficients of variation  $CV_{AA}$  shall be lower than or equal to 6 per cent.  $CV_{AA}$  shall be calculated for minimum 6 valid runs according to

$$CV_{AA} = 100\% \cdot \frac{\sigma_{AA}}{\overline{AA}}$$

where

$\sigma_{AA} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (AA_i - \overline{AA})^2}$  denotes the corrected sample standard deviation and

$\overline{AA}$  the arithmetic mean of the Average Accelerations ( $AA_i$ ) of  $N$  test runs."

*Paragraph 4.8.2.*, amend to read:

"4.8.2. Validation of results

For the candidate tyres:

The coefficient of variation  $CV_{AA}$  of the average acceleration is calculated according to the formula in 4.7.5.4. of this Annex for all the candidate tyres. If one coefficient of variation is greater than 6 per cent, discard the data for this candidate tyre and repeat the test.

For the reference tyre:

If the coefficient of variation  $CV_{AA}$  of the average acceleration calculated according to the formula in 4.7.5.4. of this Annex for each group of min 6 runs of the reference tyre is higher than 6 per cent, discard all data and repeat the test for all tyres (the candidate tyres and the reference tyre).

In addition and in order to take in account possible test evolution, the coefficient of validation  $CVal_{AA}(SRTT)$  is calculated on the basis of the average values of any two consecutive groups of minimum 6 runs of the reference tyre according to

$$CVal_{AA}(SRTT) = 100\% \times \left| \frac{\overline{AA_2} - \overline{AA_1}}{\overline{AA_1}} \right|$$

If the coefficient of validation is greater than 6 per cent, discard the data for all the candidate tyres and repeat the test."

Paragraph 4.8.3., amend to read:

"4.8.3. Calculation of the weighted averages

Weighted averages  $wa_{SRTT}$  of the average accelerations of two successive tests of the SRTT are calculated according to Table 1:

Table 1

<i>If the number of sets of candidate tyres between two successive runs of the reference tyre is:</i>	<i>and the set of candidate tyres to be qualified is:</i>	<i>then <math>wa_{SRTT}</math> is calculated by applying the following:</i>
1   R – T1 – R	T1	$wa_{SRTT} = \frac{1}{2}(\overline{AA_{R1}} + \overline{AA_{R2}})$
2   R – T1 – T2 – R	T1 T2	$wa_{SRTT} = \frac{2}{3}\overline{AA_{R1}} + \frac{1}{3}\overline{AA_{R2}}$ $wa_{SRTT} = \frac{1}{3}\overline{AA_{R1}} + \frac{2}{3}\overline{AA_{R2}}$
3   R – T1 – T2 – T3 – R	T1 T2 T3	$wa_{SRTT} = \frac{3}{4}\overline{AA_{R1}} + \frac{1}{4}\overline{AA_{R2}}$ $wa_{SRTT} = \frac{1}{2}(\overline{AA_{R1}} + \overline{AA_{R2}})$ $wa_{SRTT} = \frac{1}{4}\overline{AA_{R1}} + \frac{3}{4}\overline{AA_{R2}}$

where  $\overline{AA_{Rn}}$  is the arithmetic mean of the average accelerations in the n-th test of the Standard Reference Test Tyre."

Paragraph 4.8.4., should be deleted.

Paragraph 4.8.5., renumber to 4.8.4. and amend to read:

"4.8.4. Calculation of the relative snow grip index of the tyre

The Snow grip index represents the relative performance of the candidate tyre compared to the reference tyre.

$$SG(Tn) = \frac{\overline{AA_{Tn}}}{wa_{SRTT}}$$

where  $\overline{AA_{Tn}}$  is the arithmetic mean of the average accelerations of the n-th candidate tyre."

Paragraph 4.8.6., renumber to 4.8.5.

Paragraph 4.9.2., amend to read:

"4.9.2. Principle of the approach

The principle lies upon the use of a control tyre and 2 different vehicles for the assessment of a candidate tyre in comparison with a reference tyre.

One vehicle can fit the reference tyre and the control tyre, the other the control tyre and the candidate tyre. All conditions are in conformity with paragraph 4.7. above.

The first assessment is a comparison between the control tyre and the reference tyre. The result (Snow grip index 1) is the relative efficiency of the control tyre compared to the reference tyre.

The second assessment is a comparison between the candidate tyre and the control tyre. The result (Snow grip index 2) is the relative efficiency of the candidate tyre compared to the control tyre.

The second assessment is done on the same track as the first one. The air temperature must be in the range of  $\pm 5$  °C of the temperature of the first assessment. The control tyre set is the same set as the set used for the first assessment.

The snow grip performance index of the candidate tyre compared to the reference tyre is deduced by multiplying the relative efficiencies calculated above:

$$\text{Snow Grip Index} = \text{SG1} \times \text{SG2}$$

Appendix 2, amend to read:

"Part 1 – Report

...

2. Name and address of the Retreader:

...

4. Brand name and trade description:

...

7. Snow grip index relative to SRTT according to paragraph 7.2.1.

...

Part 2 – Test data

...

4. Test tyre details and data:

	<i>SRTT (1<sup>st</sup> test)</i>	<i>Candidate 1</i>	<i>Candidate 2</i>	<i>SRTT (2<sup>nd</sup> test)</i>
Brand name				
Trade Description/ commercial name				
Tyre size designation				
Service description				
Test rim width code				
Reference (test) inflation pressure <sup>(1)</sup> (kPa)				
Tyre loads F/R (kg)				
Tyre Loads F/R (% of load associated to LI <sup>(2)</sup> )				
Tyre pressure F/R(kPa)				

5. Test results: mean fully developed decelerations ( $\text{m} \cdot \text{s}^{-2}$ ) coefficient<sup>(3)</sup>.

<i>Run number</i>	<i>Specification</i>	<i>SRTT (1st test)</i>	<i>Candidate 1</i>	<i>Candidate 2</i>	<i>SRTT (2nd test)</i>
1					
2					
3					
4					
5					
6					
Mean					
Standard deviation					
Coefficient of variation	$CV_a \leq 6 \%$				
Coefficient of Validation	$CVal_a(SRTT) \leq 5 \%$				
SRTT weighted average					
Snow grip index		1.00			

"

Add footnotes (1) and (2) and renumber the existing footnote (1) to (3):

"(1) For C2 tyres, corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation

(2) For C2 tyres, refer to single load

(3) Strike out what does not apply."

*Appendix 3*, amend to read:

"Part 1 – Report

...

2. Name and address of the Retreader:

...

4. Brand name and trade description:

...

7. Snow grip index relative to SRTT according to paragraph 7.2.1.

...

Part 2 – Test data

...

4. Test tyre details and data:

	SRTT (1 <sup>st</sup> test)	Candidate 1	Candidate 2	Candidate 3	SRTT (2 <sup>nd</sup> test)
Brand name					
Trade Description/ commercial name					
Tyre size designation					
Service description					
Test rim width code					
Reference (test) inflation pressure <sup>(1)</sup> (kPa)					
Tyre loads F/R (kg)					
Tyre Loads F/R (% of load associated to LI <sup>(2)</sup> )					
Tyre pressure F/R(kPa)					

5. Test results: mean fully developed decelerations ( $m \cdot s^{-2}$ ) coefficient.

Run number	Specification	SRTT (1st test)	Candidate 1	Candidate 2	Candidate 3	SRTT (2nd test)
1						
2						
3						
4						
5						
6						
Mean						
Standard deviation						
Coefficient of variation	$CV_a \leq 6 \%$					
Coefficient of Validation	$CVal_a(SRTT) \leq 6 \%$					
SRTT weighted average						
Snow grip index		1.00				

Add footnotes (1) and (2) to read:

"(1) Corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation.

"(2) Refer to single load."