Transmitted by the experts of the IWG WGWT

Informal document **GRBP-76-05**
(76th GRBP, 5-7 September 2022,
agenda item 4 (c))

Proposal to amend documents ECE/TRANS/WP.29/GRBP/2022/22

The changes are marked in **bold** for added text and strike through for deleted text, all in red font.

Paragraph 2.18., amend to read:

"2.18. "*Standard Reference Test Tyre*" or "*SRTT*" means a tyre that is produced, controlled and stored in accordance with the standards of ASTM International:

(a) E1136 – 17 for the size P195/75R14 and referred to as "SRTT14",

(b) F2493 – 20 for the size P225/60R16 and referred to as "SRTT16",

(c) [F####-##] for the size P225/60R16 in worn state and referred to as "moulded SRTT16 worn"

(~~c~~**d**) F2872 – 16 for the size 225/75R16C and referred to as "SRTT16C",

(~~d~~**e**) F2871 – 16 for the size 245/70R19.5 and referred to as "SRTT19.5",

(~~e~~**f**) F2870 – 16 for the size 315/70R22.5 and referred to as "SRTT22.5"."

Insert a new paragraph 12.9., to read:

"12.9. ~~[~~**Until 6 July 2024**~~]~~**, Contracting Parties applying this Regulation may continue to grant type approvals of class C1 tyres according to the 03 series of amendments to this Regulation, based on the test procedures for measuring the wet adhesion of tyres in worn state as described in Annex 9 to this Regulation using buffed SRTT16 in worn state as reference tyre."**

Insert a new paragraph 12.10., to read:

"12.10. Notwithstanding paragraph 12.9., Contracting Parties applying this Regulation shall continue to grant extensions to existing type approvals of class C1 tyres according to the 03 series of amendments to this Regulation first granted before 7 July 2024, based on the test procedures for measuring the wet adhesion of tyres in worn state as described in Annex 9 to this Regulation using buffed SRTT16 in worn state as reference tyre. In case a new test has to be performed on a different representative tyre size for an extension to be granted after 7 July 2024, the moulded SRTT16 worn shall be used."

Annex 1, Paragraph 8.3., amend to read :

"8.3. Wet adhesion level of tyres in worn state of representative size, see paragraph 2.7. of this Regulation, as per ~~item Y. of~~ the test report in the appendix to Annex 9: …… (G_B) using the vehicle or trailer method[2]"

Annex 5, part (B), paragraph 2.1.2.1., amend to read:

"2.1.2.1. Fit the test tyres on rims specified by a recognized tyre and rim standards organization as listed in Appendix 4 to Annex 6 to this Regulation. Ensure

proper bead seating by the use of a suitable lubricant. Excessive use of lubricant should be avoided to prevent slipping of the tyre on the wheel rim.

Check the test tyres for the specified inflation pressure at ambient temperature (cold), just prior to testing. For the purpose of this standard the testing tyre cold inflation pressure P_t shall be calculated as follows:

~~$P_t = P_r \times \left(\frac{Q_t}{Q_r}\right)^{1.25}$~~ $\boldsymbol{P_t = P_r \cdot \left(\frac{Q_t}{Q_r}\right)^{1.25}}$

Where:

~~P_r~~ $\boldsymbol{P_r}$ = Inflation pressure corresponding to the ~~the~~ indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation.

~~Q_t~~ $\boldsymbol{Q_t}$ = The static test load of the tyre

~~Q_r~~ $\boldsymbol{Q_r}$ = The maximum mass associated with the load capacity index of the tyre"

Annex 7, paragraph 3.1.4.2., amend to read:

"3.1.4.2. For class C2 tyres, the vehicle load shall be such that the resulting loads on the tyres are between 60 per cent and 100 per cent of the load corresponding to the tyre load **capacity** index.

The static tyre load on the same axle should not differ by more than 10 per cent.

The inflation pressure is calculated to run at constant deflection:

For a vertical load higher or equal to 75 per cent of the load capacity of the tyre, a constant deflection is applied, hence the test inflation pressure ~~"Pt"~~ $\boldsymbol{P_t}$ shall be calculated as follows:

~~$P_t = P_r \left(\frac{Q_t}{Q_r}\right)^{1.25}$~~ $\boldsymbol{P_t = P_r \cdot \left(\frac{Q_t}{Q_r}\right)^{1.25}}$

~~Qr~~ $\boldsymbol{Q_r}$ is the maximum load associated to the load capacity index of the tyre written on the sidewall

~~Pr is the reference pressure corresponding to the maximum load capacity Qr~~

$\boldsymbol{P_r}$ is the inflation pressure corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation.

~~Qt~~ $\boldsymbol{Q_t}$ is the static test load of the tyre

For a vertical load lower than 75 per cent of the load capacity of the tyre, a constant inflation pressure is applied, hence the test inflation pressure ~~Pt~~ $\boldsymbol{P_t}$ shall be calculated as follows:

~~$P_t = P_r (0.75)^{1.25} = (0.7) P_r$~~ $\boldsymbol{P_t = P_r \times (0.75)^{1.25} = 0.7\ P_t P_r}$

~~Pr~~ $\boldsymbol{P_r}$ ~~is the reference pressure corresponding to the maximum load capacity Qr~~ ~~$\boldsymbol{Q_r}$~~ **is the inflation pressure corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation.**

Check the tyre pressure just prior to testing at ambient temperature."

Annex 8,

Paragraph 2.4.2.2., amend to read:

"2.4.2.2. This adjusted mean fully developed deceleration $d_{m,adj}(R)$ of the reference tyre is calculated in accordance with Table 3, where $d_{m,ave}(R_i)$ and $d_{m,ave}(R_f)$ are the arithmetic means of the mean fully developed decelerations in the initial and in the final braking test of the reference tyre within a braking test cycle.

Table 3
Calculation of the adjusted mean fully developed deceleration $d_{m,adj}(R)$ of the reference tyre

If the number and the sequence of candidate tyres within one braking test cycle is	*and the candidate tyre to be qualified is*	*the corresponding adjusted mean fully developed deceleration $d_{m,adj}(R)$ of the reference tyre is calculated as follows*
1 ~~R1 T1 R2~~ **R_i – T_1 – R_f**	~~T1~~ **T_1**	$d_{m,adj}(R) = {}^1/_2 \cdot [d_{m,ave}(R_i) + d_{m,ave}(R_f)]$
2 ~~R1 T1 T2 R2~~ **R_i –T_1 – T_2 – R_f**	~~T1~~ **T_1**	$d_{m,adj}(R) = {}^2/_3 \cdot d_{m,ave}(R_i) + {}^1/_3 \cdot d_{m,ave}(R_f)$
	~~T2~~ **T_2**	$d_{m,adj}(R) = {}^1/_3 \cdot d_{m,ave}(R_i) + {}^2/_3 \cdot d_{m,ave}(R_f)$

Second occurrence of paragraph 2.4.2.2., renumber as 2.4.2.3.

Second occurrence of paragraph 2.4.4.4., renumber as 2.4.4.5.

Paragraph 2.4.4.5. (former), renumber as 2.4.4.6.

Paragraph 2.4.5.2.1., amend to read:

"2.4.5.2.1. In a first series of three non-consecutive braking test cycles, using the procedure described in paragraph 2.1.3.2. to ~~2.4.4.5.~~ **2.4.4.6.** of this Annex in which the control tyre shall be treated as a candidate tyre, the ice grip index $G_{I,1}(C)$ of the control tyre relative to the reference tyre shall be established. In a second series of three non-consecutive braking test cycles, in which the control tyre serves as reference tyre, the ice grip index $G_{I,2}(T)$ of the candidate tyre relative to the control tyre shall be established."

Annex 9,

Paragraph 2.1.1., amend to read:

"2.1.1. "***T**yre in worn state*" or "*worn tyre*" means, for the purpose of this Regulation, a new tyre artificially worn by reducing the tread depth **or, with respect to the reference tyre in worn state, moulded** at the height **defined in paragraph 2.2.1.2.4.1. of this Annex.** ~~of the tread wear indicator as defined in the UN Regulation No. 30 (1.6 +0.6 / −0.0 mm).~~"

Paragraph 2.1.13., amend to read:

"2.1.13. "*Reference tyre in worn state*" or "*Reference tyre set in worn state*" means a tyre or a tyre set of Standard Reference Test Tyres ~~SRTT16 in worn state~~ **moulded SRTT16 worn**. "

~~*Paragraph 2.3.2.2.*, amend to read:~~

~~"2.3.2.2. Using the procedure described in paragraph 2.4.2. of this Annex, perform in the same area where the average macro texture depth was measured one braking test of the reference tyre, consisting of at least six (6) test runs in the same direction.~~

~~Evaluate the braking test as described in paragraphs 2.4.2.1.1. and 2.4.2.1.2. of this Annex. If the coefficient of variation CV_μ exceeds 4 per cent, dismiss the results and repeat the braking test.~~

~~The arithmetic mean ($\overline{\mu_{peak}}$) of the measured peak braking force coefficients shall be corrected for effects of temperature as follows:~~

~~$\mu_{peak,corr} = \overline{\mu_{peak}} + a \cdot (\vartheta - \vartheta_0)$~~

~~Where~~

~~ϑ is the wetted road surface temperature in degrees Celsius~~

~~$a = 0.002\ °C^{-1}$ and $\vartheta_0 = 20\ °C$.~~

~~The temperature corrected average peak braking force coefficient ($\mu_{peak,corr}$) shall be not less than **[0.45 and not greater than 0.80]**."~~

Paragraph 2.4.1.1.4., amend to read:

" 2.4.1.1.4. Calculation of the wet grip index of the candidate tyre

The wet grip index $G_B(T_n)$ of the candidate tyre T_n (n = 1, 2 or 3) is calculated as follows:

$$G_B(T_n) = K_{vehicle} \cdot \{\overline{BFC_{ave}}(T_n) - [a \cdot \Delta BFC(R) + b \cdot \Delta\vartheta + c \cdot (\Delta\vartheta)^2 + d \cdot \Delta MTD]\}$$

where:

$\overline{BFC_{ave}}(T_n)$ is the arithmetic mean of the average braking force coefficients of the candidate tyre T_n within a braking test;

$$\Delta BFC(R) = BFC_{adj}(R) - BFC(R_0)$$

$BFC_{adj}(R)$ is the adjusted average braking force coefficient in accordance with Table 1 **of Annex 5**;

$BFC(R_0) = 0.52$ is fixed as the braking force coefficient for the reference tyre in the reference conditions;

$$\Delta\vartheta = \vartheta - \vartheta_0$$

ϑ is the measured wet surface temperature in degrees Celsius when the candidate tyre T_n is tested;

ϑ_0 is the wetted surface reference temperature for the candidate tyre according to its category of use as listed in Table 2;

$$\Delta MTD = MTD - MTD_0$$

MTD is the measured macro texture depth in mm of the track (see paragraph 3.1.4. of this Annex);

$MTD_0 = 0.8$ mm is the macro texture depth of the reference track;

$K_{vehicle}$ = ~~[~~**1.95**~~]~~ is a factor to grant consistency between previous calculation of the wet grip index and this one, and to ensure convergence between vehicle and trailer method and

coefficients a, b, c and d are given in Table 2.

Table 2

Category of use		ϑ_0 (°C)	a	b ($°C^{-1}$)	c ($°C^{-2}$)	d (mm^{-1})
Normal tyre		20	+0.90996	−0.00179	−0.00013	−0.10313
Snow tyre		15	+0.81045	−0.00004	−0.00019	−0.05093
	Snow tyre for use in severe snow conditions	10	+0.71094	+0.00172	−0.00025	+0.00127
Special use tyre		not defined				

"

~~*Paragraph 2.4.1.1.2.*, amend to read:~~

~~"2.4.1.1.2. Validation of results~~

~~The coefficient of variation CV_{BFC} is calculated as follows:~~

$$~~CV_{BFC} = 100\% \cdot \frac{\sigma_{BFC}}{\overline{BFC_{ave}}}~~$$

~~where~~

~~$\sigma_{BFC} = \sqrt{\frac{1}{N-1}\sum_{j=1}^{N}\left(BFC_{ave,j} - \overline{BFC_{ave}}\right)^2}$ denotes the corrected sample standard deviation and~~

~~$\overline{BFC_{ave}}$ the arithmetic mean of the average braking force coefficients $BFC_{ave,j}$ of N test runs.~~

~~For the reference tyre:~~

~~(a) The coefficient of variation CV_{BFC} of the initial and the final braking test of the reference tyre within one test cycle shall be less than or equal to 4 per cent.~~

~~(b) The arithmetic means of the average braking force coefficients of the initial and the final braking test shall not differ by more than 5 per cent of the average of the two values:~~

$$~~CVal(BFC_{ave}) = 100\% \cdot 2 \cdot \frac{\left|\overline{BFC_{ave}}(\mathrm{R_i}) - \overline{BFC_{ave}}(\mathrm{R_f})\right|}{\left|\overline{BFC_{ave}}(\mathrm{R_i}) + \overline{BFC_{ave}}(\mathrm{R_f})\right|} \leq 5\%~~$$

~~where~~

~~$\overline{BFC_{ave}}(\mathrm{R_i})$ and $\overline{BFC_{ave}}(\mathrm{R_f})$ are the arithmetic means of the average braking force coefficients respectively in the initial and final braking tests of the reference tyre within a test cycle.~~

~~(c) The temperature corrected average braking force coefficients ($BFC_{ave,corr}$, see paragraph 3.2.1. of this Annex) as calculated from the initial and from the final braking tests of the reference tyre within a test cycle shall be not less than **[0.40 and not greater than 0.65].**"~~

Paragraph 2.4.2.1.4., amend to read:

"2.4.2.1.4. Calculation of the wet grip index of the candidate tyre

The wet grip index $G_B(\mathrm{T}_n)$ of the candidate tyre T_n (n = 1, 2, 3) is calculated as follows:

$$G_B(\mathrm{T}_n) = K_{\mathrm{trailer}} \cdot \left\{\overline{\mu_{peak}}(\mathrm{T}_n) - \left[a \cdot \Delta\mu_{peak}(\mathrm{R}) + b \cdot \Delta\vartheta + c \cdot (\Delta\vartheta)^2 + d \cdot \Delta MTD\right]\right\}$$

where:

$\overline{\mu_{peak}}(\mathrm{T}_n)$ is the arithmetic mean of the peak braking force coefficients of the candidate tyre T_n within a braking test;

$$\Delta\mu_{peak}(\mathrm{R}) = \mu_{peak,adj}(\mathrm{R}) - \mu_{peak}(R_0)$$

$\mu_{\mathrm{peak,adj}}(\mathrm{R})$ is the adjusted peak braking force coefficient in accordance with Table 3 **of Annex 5**;

$\mu_{\mathrm{peak}}(\mathrm{R_0}) = 0.71$ is fixed as the peak braking force coefficient for the reference tyre in the reference conditions;

$$\Delta\vartheta = \vartheta - \vartheta_0$$

ϑ is the measured wet surface temperature in degrees Celsius when the candidate tyre $\mathrm{T_n}$ is tested;

ϑ_0 is the wetted surface reference temperature for the candidate tyre according to its sidewall marking as listed in Table 4;

$$\Delta MTD = MTD - MTD_0$$

MTD is the measured macro texture depth of the track

MTD_0 = 0.8 mm is fixed as the macro texture depth of the reference track;

$K_{trailer}$ = ~~[~~**1.50**~~]~~ is a factor to grant consistency between previous calculation of the wet grip index and this one, and to ensure convergence between vehicle and trailer method and

coefficients *a*, *b*, *c* and *d* are given in Table 4.

Table 4

Category of use		ϑ_0 (°C)	*a*	*b* ($°C^{-1}$)	*c* ($°C^{-2}$)	*d* (mm^{-1})
Normal tyre		20	+0.99655	−0.00124	+0.00041	+0.06876
Snow tyre		15	+0.94572	−0.00032	−0.00020	+0.08047
	Snow tyre for use in severe snow conditions	10	+0.89488	+0.00061	−0.00080	+0.09217
Special use tyre		not defined				

"

Paragraph 2.3.1.5., amend to read:

"2.3.1.5. The wetted frictional properties of the surface shall be measured using the Standard Reference Test Tyre ~~SRTT16 in worn state~~ **moulded SRTT16 worn** either with the method described in paragraph 2.3.2.1 of this Annex in case the vehicle method (according to paragraph 2.4.1. below) is used, or with the method described in paragraph 2.3.2.2 in this Annex in case the trailer (or tyre test vehicle) method is used."

Insert a new paragraph 2.2.1.2.4.1.1., to read:

"2.2.1.2.4.1.1. The rim width shall be one specified by a recognized tyre and rim standards organization as listed in Appendix 4 to Annex 6 to this Regulation. The rim width code shall not differ by more than 0.5 from the measuring rim width code. "

Insert a new paragraph 2.2.1.2.4.1.2., to read:

"2.2.1.2.4.1.2. The inflation pressure for the tread depth measurement shall be between 180 kPa and 220 kPa. "

II. Justification

1. The test campaign studying the moulded SRTT16 worn performance (April – June 2022) has demonstrated that with the introduction of moulded SRTT16 worn there is no need to change K trailer, K vehicle and track friction range factors as written in the regulation today. Technical details are available in document WT-43-2v1.

2. The additional transitional provision at paragraph 12.10. proposes to allow, for extensions on existing type approvals already issued before 7 July 2024 based on tests performed by using the buffed SRTT16, to not redo test for the only purpose of the retest compared to moulded SRTT16 worn for extensions (that doesn't require a test) of existing type approvals after 7 July 2024.