

Consolidated Statement on Technical Rationale and Justification after the IWG TYREGTR 21st meeting

EXECUTIVE SUMMARY

Initial Establishment of the GTR

Global Technical Regulation (gtr) No. 16 for Tyres applies to new radial pneumatic tyres for Category 1 and 2 vehicles up to and including 4,536 kg (10,000 pounds). At an early stage it was decided to develop gtr No. 16 in two stages, initially for passenger tyres and at a later stage for light truck (commercial) (LT/C) tyres.¹

In developing gtr No. 16, a number of different national regulations were reviewed. For passenger tyres, some of the requirements considered for the gtr existed in only a single national regulation and therefore were adopted without the need for harmonization. These requirements are the endurance test, the low pressure endurance test, the bead unseating test, the strength test, the rolling sound emission test, the wet grip test and the run flat test. Other requirements required harmonizing differing national regulations, including markings and tread wear indicators, the high speed test and the physical dimension test. For passenger tyres, these requirements were arranged in a “general module” plus two options.²

While an agreement had been reached to harmonize passenger tyre recommendations only in the initial establishment of gtr No. 16, a number of unharmonized requirements for LT/C tyres taken from Regulations No. 54 and 117 and Federal Motor Vehicle Safety Standard (FMVSS) 139 were included for reference. These requirements were: markings and tread wear indicators (both), physical dimensions (both), high speed test (both), endurance test (both³), low pressure endurance test (FMVSS 139), strength test (FMVSS 139), bead unseating test (FMVSS 139), and rolling sound emissions (Regulation No. 117).

For a complete discussion of the establishment of gtr No. 16 see [paragraphs 1-36] of the Statement of Technical Rationale and Justification.

Amendment 1

Parallel with the development of gtr No. 16, Regulation No. 117 was amended several times. As it was not feasible to consider these amendments during the development of the gtr, it was decided to consider them as a Phase 1b prior to beginning work to harmonize the requirements for LT/C tyres. Amendment 1 amended the wet grip test in the gtr to the most recent version from Regulation No. 117. Amendment 1 also amended the gtr to add two new requirements taken from Regulation No. 117 – the rolling resistance test and the test for classification of a snow tyre for use in severe snow conditions.

For a complete discussion of Amendment 1 to gtr No. 16 see [paragraphs 4bis, 4ter, 22bis, 28bis, 28ter, and 37-48] of the Statement of Technical Rationale and Justification.

Amendment 2

¹ See section 2 of the gtr for definitions of these tyre types.

² Option 1 consisting of the strength test and the bead unseating test. Option 2 consisting of the rolling sound emission test.

³ The Regulation No. 54 “endurance” test is only for lower speed tyres, P speed rated and below (</- 150 km/h). For tyres Q and above, the Reg 54 requirement is a high speed type test.

The Amendment No. 2 to gtr No. 16 addresses the harmonization of the previously non-harmonized tests applicable to for light truck / commercial (LT/C) tyres, specifically Physical Dimensions Test and High Speed Test. The Amendment No. 2 to gtr No. 16 will also cover the most recent updates of UN Regulations Nos. 30 and 54 as well as FMVSS of the United States.

For a complete discussion of Amendment 2 to gtr No. 16 see [paragraphs ?] of the Statement of Technical Rationale and Justification.

I. Statement of technical rationale and justification

A. Introduction and procedural background

1. The objective of this Global Technical Regulation (gtr) is to establish provisions for new radial pneumatic tyres equipping passenger cars and light truck (commercial) vehicles up to and including 4,536 kg (10,000 pounds) under the 1998 Agreement. The official bases of this harmonized set of requirements are Regulations Nos. 30, and 54 and 117 annexed to the 1958 Agreement, as well as the Federal Motor Vehicle Safety Standard (FMVSS) 139 requirements established in the United States of America under the direction of the National Highway Traffic Safety Administration (NHTSA). Regulations from Gulf States Organization (GSO), India and China, although not officially registered in the compendium of regulations for the tyre gtr, were also analysed and requirements from them were considered in this gtr insofar as they were not already covered by one of the regulations from UNECE and United States of America. In addition, parts of FMVSS 109 and 119 were copied directly into this gtr, since they are applicable to certain tyres for light commercial vehicles (LT or C tyres).

2. Many countries throughout the world have already introduced regulations concerning pneumatic tyres. Many of the existing regulations are based on the four primary ones mentioned above. However, many differences in test conditions and regulatory marking requirements require tyre manufacturers to produce almost identical products but with market specific variations to meet local market requirements – including slight variations on sidewall marking provisions.

2bis. Consistent with section 7 of the 1998 Agreement Concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles, any individual provision in the gtr for tyres may be transposed into the national regulations of a contracting party at its discretion.

3. The first phase of the gtr for tyres harmonized the requirements for passenger car tyres, while Amendment 1 updated the passenger car requirements to include recent amendments to UN and U.S. regulations. Amendment 2 harmonized several provisions for LT and C-type tyres...

3bis. Amendment 2 to gtr No. 16 addressed the technical specification for the harmonization of tyres with the designation of LT or C. See the discussion beginning at paragraph [insert] for further details.

4. Additional technical evaluation is necessary to assess whether consideration should be given for certain tyre types typical in the North American market in relation to the specifications in paragraph 3.12. (referring to the test for adhesion performance on wet

surfaces). Government and industry in the United States of America are coordinating to conduct this evaluation.

4bis. For the purposes of future harmonization, it is noted that amendments are anticipated in the areas of the Strength test for passenger car tyres (section 3.6) and the Tubeless tyre bead unseating resistance test for passenger car tyres (section 3.7). For both tests, work is underway in the United States to modify the test conditions or performance requirements.

4ter. Following additional technical evaluation of the adhesion performance on wet surfaces (section 3.12), a future additional category of use might be necessary for certain tyre types typical in the North American market.

B. Background of tyre regulations

5. Radial pneumatic tyres for passenger cars and light vehicles are increasingly becoming worldwide products, expected to be used anywhere in the world when mounted as original equipment on new vehicles which are themselves marketed on a global basis. This globalization creates significant opportunities for manufacturers to deliver better and more cost efficient products but also requires harmonization of the technical provisions at a global level to avoid increasing manufacturing costs.

6. Although testing requirements for different regulations used around the world are often substantially similar, slight variations in test procedures oblige tyre manufacturers to test the same object for the same performance characteristic under slightly different conditions, without any significant improvement in the final product.

7. Marking requirements are also variable around the world, and the same tyre may need several different approval marks to be marketed in a truly worldwide fashion. Any harmonization of such markings should continue to be a priority, as it would clarify the administrative identity of the tyre and facilitate the management of production moulds.

C. Procedural background and development of the global technical regulation

8. This gtr was developed by the GRRF informal working group on the Tyre gtr.

9. The work on this gtr began informally in December of 2004 with a meeting in Paris. As required by the 1998 Agreement, a formal proposal for the establishment of a tyre gtr was proposed to the Executive Committee of the 1998 Agreement (AC.3) by the technical sponsor, France. At the 140th session of the World Forum for Harmonization of Vehicle Regulations (WP.29) on 14 November 2006, the French proposal was approved as a gtr project by AC.3 (ECE/TRANS/WP.29/2006/139). The adopted proposal was published as ECE/TRANS/WP.29/AC.3/15.

10. Subsequent to that approval, the informal working group on Tyre gtr met on numerous occasions. In addition to three unofficial meetings held between December 2004 and November 2006, another ten meetings were scheduled in conjunction with GRRF sessions and a further two interim meetings were held in Brussels in July 2007 and July 2009.

11. In 2009, at the request of the informal working group, AC.3 approved the development of the gtr in two phases: the initial phase being dedicated to harmonizing requirements for passenger car tyres only, and requirements for light truck tyres, which carry a C or LT designation, to be harmonized as a second phase. In the interim, the existing requirements for C or LT tyres (albeit non-harmonized) are included in the first

stage of the gtr for completeness. The current document reflects that decision and contains only harmonized requirements for passenger car tyres, with the LT/C requirements remaining to be harmonized.

12. Tests or requirements for radial passenger car tyres required extensive harmonization during the course of the informal working group's mandate. These harmonized tests or requirements are:

- (a) High speed test;
- (b) Physical dimensions test;
- (c) Required markings.

13. Several other test requirements for radial passenger car tyres existed only in one of the existing regulations and needed no harmonization. These tests were simply included as direct copies in the gtr for tyres. In particular, no harmonization was required for:

- (a) Endurance test;
- (b) Low pressure endurance test;
- (c) Bead unseating test;
- (d) Strength test;
- (e) Rolling sound emission test;
- (f) Wet grip test;
- (g) Run flat test.

14. Harmonizing the high speed test **for passenger car tyres** posed a significant challenge in that the two existing tests were quite different from each other and based on different principles. One was designed to ensure that a tyre would perform adequately at speeds well above a national speed limit, but the test requirements were not related to any speed symbol indicated on the tyre itself. The other required that a tyre pass a test at its highest rated speed.

15. Taking into account the long experience of FMVSS standards in the United States of America and in countries applying Regulation No. 30, and the huge **volume** of test results corresponding to these two testing procedures, it was decided to base harmonization on a combination of the two existing test procedures rather than develop a wholly new harmonized test procedure. The harmonization work was based on a determination of which test was more onerous for tyres of different speed symbols, and using the best test procedure.

16. At the meeting of the ad hoc working group in September 2006, three different scenarios for the high speed test harmonization were discussed. One of the options considered was to use the FVMSS 139 high speed test for tyres with a speed rating equivalent to the symbol of "S" and below (less than or equal to 180 km/h), and the Regulation No. 30 test for speed symbols above "S" (greater than 180 km/h). At that meeting, there was a general consensus by the Contracting Parties that this proposal could be considered as a starting point, but it would require significant further work in order to demonstrate the validity of the proposal.

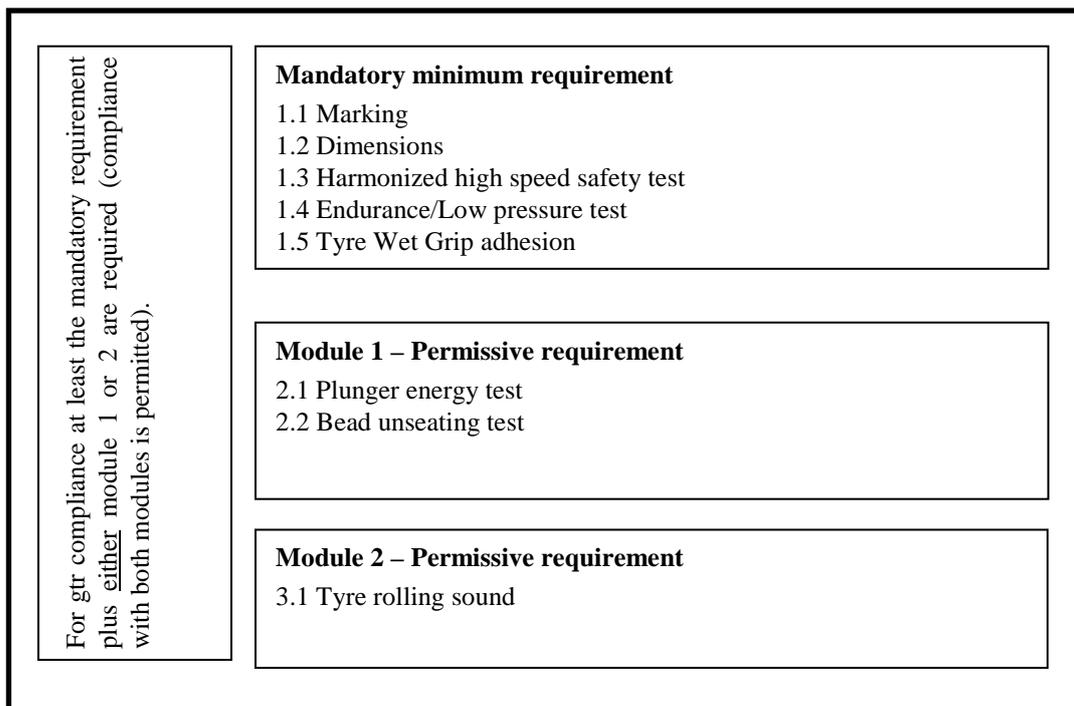
17. The tyre industry presented a theoretical method to determine, for each speed symbol, the test which is the most severe and to validate that the equivalence point (the speed symbol for which both tests are equally severe) between the two tests is reached at a specific speed symbol. Over the following year the tyre industry gathered data to demonstrate this concept. Six tyre manufacturers supplied data, and in total, 704 tyres were

tested using both tests. All the tyres were tested above and beyond the normal high speed test requirements, and the number of steps that each tyre was able to withstand above the regulatory limit, were counted. The ratio of the number of Steps above the Limit (SAL) for the FMVSS 139 test, divided by the number of steps above the limit for Regulation No. 30 test was used to evaluate the data. Based on this extensive set of data, it was determined that the FMVSS 139 high speed test was more severe for tyres with speed symbol of S and below (less than or equal to 180 km/h). The Regulation No. 30 high speed test was more severe for tyres with speed symbols of T (190 km/h) and above.

18. To validate this concept further, work was undertaken on a smaller sample of tyres to determine the temperature increase during the different tests. In all cases, it was demonstrated that for T rated tyres and above, greater energy input was required (as determined by the increase in the contained air temperature) during the Regulation No. 30 test than from the FMVSS 139 test. This data was also independently confirmed by one of the Contracting Parties. Since the increase in temperature of a tyre should be directly related to the amount of energy supplied during the test, a higher internal tyre temperature at the end of a test indicates a higher degree of severity. At the meeting in September 2008, it was agreed to use the Regulation No. 30 test for tyres with speed symbols of T (190 km/h) and above, and to use the FMVSS 139 high speed test for all lower speed symbols (180 km/h and below).

19. The physical dimensions test was less difficult to harmonize from a technical point of view, because of the elementary simplicity of determining the outside diameter and width of a tyre in its inflated state to ensure interchangeability between tyres marked with the same size designation. A small but not insignificant gain has been achieved by harmonizing the measuring of the tyre's width at four points around the circumference.

20. After the inventory of different tests for passenger car tyres existing in the world had been made, it appeared that some of these tests might be harmonized on a worldwide level, while some of them appeared to have a more regional application. In order to take this situation into account, the technical sponsor of the tyre gtr proposed to organize the different tests into three modules: **a mandatory minimum requirement and two permissive requirements.**



21. This modular structure was described in document ECE/TRANS/WP.29/AC.3/15 that was adopted by AC.3 as the formal request of authorisation to develop the gtr.

22. The informal working group developing the gtr pursued the modular approach. As the group continued to develop the modular approach a wider appreciation among Contracting Parties of the application of modules emerged. This prompted proposals for a less prescriptive approach to some of the individual elements included in the mandatory module. The informal group considered alternatives to deliver the requirements of Contracting Parties while retaining the original modular approach but could not find a sufficiently robust solution. As a result the group proposes a revised structure centred upon a "General Module" plus two options (Options 1 and 2). These are described in the table.

<i>Passenger car tyres</i>		
	<i>Test name</i>	<i>Paragraph(s)</i>
General module	Marking and tread wear indicators	3.2., 3.3. and 3.4.
	Physical dimensions	3.5.
	High speed test	3.11.
	Endurance test	3.9.
	Low pressure test	3.10.
	Wet grip test	3.12.
	Run flat test	3.13.
Option 1	Strength test	3.6.
	Bead unseating test	3.7.
Option 2	Rolling sound emissions	3.8.

22bis. However, since the gtr contains only technical prescriptions and no legal aspects concerning implementation of this gtr in national/regional legislation of the Contracting Parties to the 1998 Agreement, irrespective of the above described module concept, only a Contracting Party decides how to transpose the gtr provisions into its national/regional legislation. In order to facilitate the transposition process it may be recommended to apply a stepwise approach and for the first stage to select just those provisions and test methods of the gtr, which mostly suit the regulatory needs of a Contracting Party, and to consider, when introducing new performance requirements, the possible trade-offs with the other performances.. Meanwhile, it is anticipated that a Contracting Party will allow access to its internal market for tyres complying with the provisions of the gtr that the Contracting Party has not adopted if such tyres are in compliance with national/regional legislation of that Contracting Party.

23. In this initial version of the gtr for tyres, the harmonized requirements apply only to tyres for passenger cars. The module concept does not apply to LT/C tyres and the following table describes the tests applicable to these tyres. In Amendment 2 to gtr No. 16, harmonized requirements were added for LT/C tyres.

<i>LT/C tyres</i>	
<i>Test name</i>	<i>Paragraph(s)</i>
Marking and tread wear indicators	3.2., 3.3. and 3.4.
Physical dimensions	3.18
High speed test	3.16.
Endurance test (not harmonized)	3.17.
Wet grip test	3.12.
Run flat test	None
Strength test	3.14.
Bead unseating test	3.15.
Rolling sound emissions	3.8.
Tyre rolling resistance	3.22

24. In the case of required markings, it was possible to eliminate some that had become unnecessary over the years, such as the words Radial and Tubeless. Indeed over 90 per cent of passenger car tyres and LT/C tyres sold worldwide are radial and tubeless construction and so continuing to mark tyres is unnecessary. In addition, a change was made in the way the Tyre Identification Number (TIN) will be used in combination with other markings.

25. The TIN format is based on NHTSA's **2015 change from** 2 digit plant codes to 3 digits. A symbol, the number "1" for example, will be reserved to precede **most existing** 2-digit codes, and be used exclusively for existing plant codes. The "1" is used as the prefix for existing 2-digit codes, and not be used as the leading digit for any new 3-digit codes. NHTSA will continue to assign global plant codes and the necessary information to obtain such a code is contained within the gtr.

26. The aim of the tyre gtr is to introduce the universal worldwide harmonized requirements to tyres included into the scope of the gtr. In accordance with the provisions of the 1998 Agreement, once the gtr is adopted, those Contracting Parties voting in favour of its adoption will start the process of transposing those requirements into their national legislation. In a case when a test procedure includes several options, a Contracting Party may select the option(s) at its discretion.

26bis. In the interests of moving rapidly towards creating a "global tyre" approach the Contracting Parties **should** transpose the gtr requirements in a flexible way to permit tyres complying with the full requirements access to as many markets as possible.

27. Consideration was given to harmonize the approval markings (both type approval and self-certification markings) and discussions on this issue were elevated to WP.29 and AC.3 meetings. It was concluded as not possible currently to adopt a harmonized approval marking since the compliance assessment procedures are not yet harmonized worldwide. So this gtr contains no administrative provisions on approval markings. In the absence of a harmonized marking, the Contracting Parties retain the option to assign markings to tyres, especially markings for a "global tyre", and these can be introduced within their national / regional compliance assessment systems.

28. It is anticipated that the Contracting Parties will incorporate the provisions of the gtr into regulations within their legal framework. This may include applying suitable tyre marking and so help provide for market recognition between the Contracting Parties of tyres complying with the provisions of this gtr. Such an approach might encourage wider recognition of harmonized markings and thus further the move towards a single global marking where tyres meet the full requirements established by this gtr.

28bis. In parallel to development of this gtr, UN Regulation No. 117, which is a base for this gtr, had been amended several times by detailing and extending the provisions to tyre wet grip performance, adding the provisions for rolling resistance and for classification as snow tyre for use in severe snow conditions for all tyre classes included in its scope. As harmonization of the newly introduced provisions of UN Regulation No. 117 was not feasible in a reasonable time frame, the decision for this gtr was not to consider those provisions for inclusion in the text of the gtr at that time. Those new provisions represent the state-of-the art level and are important for assessment of performance of tyres on the markets worldwide. Therefore at so-called "Phase 1b" the relevant provisions aligned with those of UN Regulation No. 117 are introduced by the Amendment No. 1 to this gtr.

28ter. The Amendment No. 1 to this gtr incorporates:

- (a) Amendment of Part I by adding new paragraphs 4bis, 22bis, 28bis and 28ter;
- (b) Amendment of Part II:
 - (i) Addition of new definitions (Section 2);
 - (ii) Modification of test for adhesion performance on wet surfaces (Section 3.12);
 - (iii) Addition of new requirements to rolling resistance (new Section 3.22);
 - (iv) Addition of new requirements for qualification of a tyre to be designated for use in severe snow conditions (new Section 3.23);
- (c) Addition of new Annexes containing the details of the newly added test methods.

28quater. The Amendment No. 2 to this gtr incorporates:

- (a) Amendment of Part I by adding new paragraphs [ADD NUMBERS];**
- (b) Amendment of Part II:**
 - (i) Alignment to scope and clarifications**
 - (ii) Alignment of the provisions with the most recent developments in UN Regulations**
 - i. Addition of new definitions**
 - ii. Alignment of the provisions for tyre marking and physical dimensions**
 - iii. Updates of the Annexes 3 and 6**
 - (iii) Elimination of inconsistencies in the text**
 - i. Reference Inflation Pressure**
 - ii. Measuring Rim**
 - (iv) New Harmonized Provisions**
 - i. Physical Dimensions**

ii. High-Speed Test

- (v) **Amendments reflecting Chinese and Indian proposals**
- (vi) **Administrative**
- (vii) **Editorial**

D. Technical and economic feasibility

29. The tyre gtr has been developed by drawing on the experience of many stakeholders, including regulatory authorities, tyre approval authorities, tyre and vehicle manufacturers and technical consultants. The gtr has been built upon the experience of many organizations and individuals with expertise in the area of tyres for passenger cars and light trucks or light commercial vehicles.

30. The tyre gtr has been designed to update and improve upon existing regulations, and the requirements are based on existing concepts in different Contracting Parties' present regulations.

31. Since this gtr is based on existing requirements and some harmonized tests, no economic or technical feasibility study was deemed necessary. When transposing this gtr into national legislation, Contracting Parties are invited to consider the economic feasibility of the gtr in the context of their country.

E. Anticipated benefits

32. The principal economic benefit of this regulation will be a reduction in the variety of tests for the same or substantially similar requirements.

33. Depending on how different Contracting Parties implement this gtr, there may be benefits due to the way the approval markings are treated. Tyre mould design and fabrication might be rationalized, with associated reductions in production costs.

34. Safety benefits resulting from the transposition of the gtr in the national legislations depend on the previous level of the national regulations.

F. Potential cost effectiveness

35. It is not possible to assess, at this moment, the total costs linked to the gtr. On one hand, there are more tests in the gtr than in the existing national or international regulations; on the other hand the harmonization of the regulation will reduce the global cost of type approval in the variety of countries which will apply the gtr through that administration procedure.

36. Safety benefits are anticipated, but it is not yet possible to assess them in terms of reduction of number of accidents and victims.

G. Specific statement of technical rational and Justification for Amendment 1 to gtr No. 16

I. Objective

37. The objective of Amendment 1 is to develop, in the framework of the 1998 Agreement, an amendment to gtr No. 16 on tyres aimed at adaptation of gtr No. 16 to the

technical progress by including the newly developed provisions to wet grip performance, rolling resistance and qualification for use at severe snow conditions both for passenger car (PC) and light truck / commercial (LT/C) tyres, recently adopted within UN Regulation No. 117. The approved changes in the relevant Federal Motor Vehicle Safety Standards (FMVSS) and UN Regulations Nos. 30 and 54 also had been included.

II. Introduction and procedural background

38. gtr No. 16 on tyres was established in the Global Registry on 13 November 2014. The informal working group on the Tyre gtr was challenged by reaching harmonization of technical provisions making those acceptable both for type approval and self-certification compliance assessment systems.

39. Meanwhile, in parallel to development of gtr No. 16, UN Regulation No. 117, which is a base for gtr No. 16, had been amended several times by inclusion of the provisions to tyre wet grip performance, rolling resistance and qualification for use at severe snow conditions for all tyre classes included in its scope. The other base UN Regulations Nos. 30 and 54 were also subjects to certain amendments, and the relevant provisions of gtr No. 16 became needed to be aligned.

40. As harmonization of the newly introduced provisions of UN Regulation No. 117 was not feasible in a reasonable time frame, the decision for draft gtr on tyres was not to consider those provisions for inclusion in the text of gtr at the time of its development.

41. As the aforesaid new provisions of UN Regulation No. 117, as well as those of UN Regulations Nos. 30 and 54 represent the state-of-the art level and are important for assessment of performance of tyres on the markets worldwide, at the 79th GRRF session the decision was made to prepare a draft amendment keeping in line the gtr on tyres with the latest regulatory developments (ECE/TRANS/WP.29/GRRF/79, para. 27).

42. The European Tyre and Rim Technical Organisation (ETRTO) agreed to prepare a draft Amendment No. 1 to gtr No. 16 considered as Phase 1b of the development of the gtr on tyres. The Government of the Russian Federation assumed the duties of the technical sponsor for that development.

III. Justification of changes

(a) Amendment of Part I

43. This Amendment 1 incorporates five new paragraphs in Part I of gtr No. 16: 4bis, 4ter, 22bis, 28bis and 28ter.

44. Paragraphs 4bis and 4ter are added for information for further anticipated amendments in gtr No. 16 to be followed the results of current rulemaking activities in the United States in the field of the Strength test for passenger car tyres (gtr No. 16 - Section 3.6) and the Tubeless tyre bead unseating resistance test for passenger car tyres (gtr No. 16-Section 3.7). Following additional technical evaluation of the adhesion performance on wet surfaces (section 3.12), a future additional category of use might be necessary for certain tyre types typical in the North American market.

45. Paragraph 22bis provides for additional clarification that no legal aspects concerning implementation of this gtr in national/regional legislation of the Contracting Parties to the 1998 Agreement is provided within the text of this gtr, therefore the way of transposition of the gtr provisions into its national/regional legislation is at the discretion of the Contracting Parties. In this regard, paragraph 22bis contains recommendations on anticipated practice of transposition of the provisions of this gtr into national/regional legislation of the Contracting Parties providing for facilitation of the transposition process. The

recommendations of paragraph 22bis are partly based on the developments of the WP.29 Informal Group dealing with the development of the procedure of International Whole Vehicle type Approval (IWVTA).

46. Paragraph 26 has been amended to clarify that when a test procedure includes several options, a Contracting Party may select the option(s) at its discretion.

47. Paragraphs 28bis and 28ter briefly explain the objective and the content of this Amendment 1 to the gtr No. 16). These two paragraphs are added for clarity and refreshment of history, when this Amendment No. 1 will be incorporated into the main text of the gtr.

(b) *Amendment of Part II*

48. See the Technical Report on the development of Amendment 1, para. 16 (i)

H. Specific statement of technical rational and Justification for Amendment 2 to gtr No. 16

I. Objective

49. The objective of Amendment 2 is to develop, in the framework of the 1998 Agreement, an amendment to gtr No. 16 aimed at further harmonization of its provisions and adaptation of gtr No. 16 to the technical progress. The most significant part of the proposal is new harmonized provisions for physical dimensions and high speed test for light truck / commercial (LT/C) tyres.

II. Introduction and procedural background

50. In the initial version of gtr No. 16, the harmonized requirements apply only to tyres for passenger cars. Although, as described in paragraph 23 of this Part, some non-harmonized tests applicable to LT/C tyres were included in the original gtr. Amendment 1 was subsequently established in the UN Global Registry on 17 November 2016, including the newly developed provisions for wet grip performance, rolling resistance and qualification for use in severe snow conditions both for passenger car and LT/C tyres.

51. GRRF at its 82nd session in September 2016 endorsed the establishment (reinstating) the tyre GTR informal working group (IWG) dealing with development of Amendment No. 2 to gtr No. 16 to harmonize provisions for LT/C tyres, including marking, high speed test and measuring tyre dimensions. In addition, the IWG was tasked with consideration of issues addressed to possible further developments of gtr 16, in particular, feasibility of harmonization of endurance test for LT/C tyres and introduction of global tyre marking. The expert from the Russian Federation proposed his leadership to develop this amendment and volunteered to request the authorization to develop Amendment 2 to gtr No. 16 from the Executive Committee of the 1998 Agreement (AC.3) (ECE/TRANS/WP.29/GRRF/82, para. 28).

52. The government of the Russian Federation assumed the duties of the technical sponsor for that development. The European Tyre and Rim Technical Organisation (ETRTO) in cooperation with other tyre manufacturers' associations agreed to assume the role of Secretary in the development of the draft Amendment No. 2 to gtr No. 16.

53. The AC.3 at its 48th session in March 2017 adopted ECE/TRANS/WP.29/2017/52 tabled by the Russian Federation to request authorization to start work on developing the Amendment No. 2 to UN GTR No. 16 (ECE/TRANS/WP.29/1129, para. 153). After the adoption, this document was assigned the reference number ECE/TRANS/WP.29/ AC.3/48.

55. At its 175th session in June 2018, The World Forum for Harmonization of Vehicle Regulations realigned work streams assigned to the various Working Parties. Tyre-related work under both the 1958 Agreement and the 1998 Agreements was removed from the Working Party on Brakes and Running Gear (GRRF) mandate and placed under the Working Party on Noise (GRB) mandate. Beginning with the 68th session of the GRB, tyre-related regulations, including the tyre gtr were discussed within GRB.

56. The IWG held [six] meetings between 2017 and 2019 to consider provisions for Amendment. 2. The IWG TYRE GTR considered several proposals during the course of these sessions.

58. Amendment No. 2 to gtr No. 16 addresses the harmonization of Physical Dimensions Test and High Speed Test for LT/C tyres. It also covers the most recent updates of UN Regulations Nos. 30 and 54 as well as FMVSS of the United States. Due to challenges associated with harmonizing the endurance test provisions, the IWG deferred further work on this topic. No other areas required harmonization, because multiple provisions did not exist for any other tests.

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III. Justification of Changes

(a) Amendment to Part I – Statement of Technical Rational and Justification

60. This Amendment 2 incorporates x new paragraphs in Part I of gtr No. 16: (insert references to new paragraphs inserted above. Recommend insertions for any proposals that would affect anything currently in the gtr for passenger car tires, then at the end of C insert one new paragraph referencing all the additional discussion here for LT/C tires).

[Starting here insert first paragraphs discussing why each inserted paragraph was inserted, followed by the new paragraphs for LT/C tires. For example:

61. Paragraph 11bis is added to clarify that the GTR has subsequently been updated to address LT/C tires.

Or

XX. Paragraph 28? is added to refer the reader to section H for a full discussion of the justification of changes related to LT/C tires in Amendment 2 of gtr No. 16.]

(b) Amendment of Part II – Text of the Global Technical Regulation

Sort paragraphs below according to the content of UN GTR No. 16

62.

57. The IWG TYREGTR considered a proposal by India that would have revised the provisions of [3.14.3.2] to address the situation when a plunger is stopped by the plunger bottoming out against the rim before reaching the specified energy value by

stating that the tyre is deemed to have passed the test at that point. India cited several international standards that recognize this situation and allow a tyre to pass the test when it occurs. The provisions in the TYREGTR are based on US regulations that currently are undergoing review. The IWG TYREGTR developed compromise language in Amendment 2, which provides that “if the tyre fails to break before the plunger is stopped on reaching the rim, and the required minimum breaking energy is not achieved, then record the bottom out and the corresponding energy. The test is deemed to have been completed, the test results are inconclusive and no further testing is required.” [3.14.3.2].

#. The IWG TYREGTR evaluated a proposal made by India to include additional minimum breaking energy values in the strength test (3.14) for small diameter tires. The IWG TYREGTR verified that values for small diameter tubeless radial tires are included in the tyre gtr.

#. The IWG considered whether several regional and national markings should be included in the gtr as proposed by the Peoples’ Republic of China. In general, the IWG TYREGTR recognized that Contracting Parties have the right to retain optional markings in national regulations under the provisions of the 1998 Agreement.

The table below lists each marking that was considered and the action/recommendation of the IWG:

<u>Regional Markings</u>	<u>IWG Action/Recommendation</u>
<i>Passenger Car Tyres and LT/C-type Tyres</i>	
<i>Marks of TWIs location</i>	The Tread Wear Indicators should be identified by the acronym ‘TWI’, or by means of a triangle, or by an arrow radially arranged on the tyre, or else by a symbol determined by the manufacturer. These indications should be moulded on the both sides of the sidewall in the tyre shoulder region.
<i>Production Code</i>	A production code marking is not included in the gtr. A Contracting Party may at the national level allow an additional optional regional marking on tyres.
<i>Inspection Mark</i>	The gtr does not require an inspection mark. A Contracting Party may at the national level allow an additional optional regional marking on tyres.
<i>Driving direction for tread pattern</i>	This type of marking should be at the discretion of a tyre manufacturer, not required by regulation. This type of marking is not included in the gtr.
<i>Name and number of plies</i>	The gtr does not require a mark indicating the name and number of plies. For reference, a table converting ply rating to load range is included in the technical rational. A Contracting Party may at the

	national level allow an additional optional regional marking on tyres.
<i>LT and C-type Tyres only</i>	
"ULT" for mini-type truck tires	The gtr does not require a mark for « ULT ». A Contracting Party may at the national level allow an additional optional regional marking on tyres.
"Regroovable"	Tyres that have a TWI should not be regrooved.

Amendment 2 provides specific ranges of reference inflation pressures for performing the prescribed tests. The established reference inflation pressure ranges correspond to Load Range inflation pressure values published by the Tire and Rim Association (TRA) as well as relevant ETRTO C-type tyre reference inflation pressures. The test prescriptions define a singular test inflation for each reference inflation pressure range to ensure common test severity. Therefore, either specifying or marking (branding) a specific Load Range (or ply rating) on the tire is no longer needed. However, since some contracting parties continue to use ply rating, the table below is provided for reference to assist contracting parties in converting from ply rating to load range, which can then be converted to reference tire inflation pressure as defined in the gtr (2.56). Ply rating is used to identify a given tire with its maximum recommended load when used in a specific type of service. It is an index of tire strength and does not necessarily represent the number of cord plies in a tire.

Load Range	Ply Rating
A	2
B	4
C	6
D	8
E	10
F	12
G	14
H	16

#. The IWG TYREGTR discussed whether to remove the publication year of the ASTM standards for the various standard reference test tyre (SRTT) standards (2.77). The IWG TYREGTR reviewed the detailed and rigorous quality assurance and control measures in place to assure that SRTT performance remains consistent. The validation process includes validation of both the tread rubber and the finished tire. The tread rubber is validated by testing samples in both the manufacturer's laboratory and an independent laboratory to assure material properties. Tire quality and performance are validated by taking a random sample of ten tires from each

build and subjecting them to physical and chemical measurements and a range of tire performance tests, including both regulatory and proprietary tests. In addition, the IWG TYREGTR noted that the revision year is not included on the sidewall of any SRTT. The IWG recognized a distinction between listing the revision year for an SRTT standard and listing a revision year for a tyre testing standard, where substantive provisions may change from revision to revision. The IWG TYREGTR agreed to remove the revision years from the ASTM SRTT standards listed in 2.77 but recognized that a Contracting Party may choose to include a revision year in its national regulations even though it may be difficult or impossible to obtain and impossible to verify a SRTT from a previous revision year.

#. Addition of new definitions (section 2). A definition was added for the term “high flotation”.

#. Harmonization of the Load Range concept in relationship to Inflation Pressure (section 2). The definition of “load range” was amended to harmonize between load range and reference test inflation pressure concepts (2.34). The terms “PSI Index” was replaced with the term “Reference Test Inflation Pressure (2.56).”

#. Alignment of the provisions for tyre marking and physical dimensions of PC tyres with the most recent developments in UN Regulations Nos. 30 and 54 (Sections 2, 3.3 and 3.5). Several definitions were amended to reflect amendments to UN Regulation 30, Regulation 117. The affected definitions included “brand name/trademark” (2.9), “carcass” (2.12), “pneumatic”, “measuring rim” and “normal tyre”. A definition of “manufacturer” (2.##) was also inserted, consistent with UN Regulation 30.

#. Harmonization of FMVSS 139 requirements relative to UN PSI index (3.14 and 3.15). In sections 3.14 (strength test) and 3.15 (bead unseat), provisions were harmonized consistent with the amendments to 2.34, the definition of “load range” to translate load range into a corresponding reference test inflation pressure.

#. Harmonization of physical dimensions provisions (Delete previous 3.20, 3.21, add new 3.20). Physical dimensions provisions were also harmonized by integrating provisions for measuring and calculating physical dimensions and assuring that all LT and C tyre sizes are addressed by the provisions. Additional provisions were added to address high flotation sizes.

#. Harmonization of inflation pressure marking provisions (3.3.5). In order to clarify the inflation pressure to be used in determining test conditions for LT and C-type tyres, the Tyre GTR defines a “Reference Test Inflation Pressure” to be marked on the sidewall (2.56). While the vast majority of LT and C-type tyres are marked with a pressure equivalent to the Reference Test Inflation Pressure, the U.S. regulation FMVSS 139 SECTION 5.5.6 allows a tyre manufacturer the option to mark a different pressure on the tyre sidewall. 3.3.5 was amended to allow for a tire to be market with both the inflation pressure corresponding to the maximum load of the tire and a reference test inflation pressure where the reference test inflation pressure differs from the inflation pressure marked for single application, consistent with U.S. regulations.

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Alignment of the provisions “1. Variation of load capacity with speed for Passenger car tyres” with the provisions in UNR 30. This provision has been added in Annex 5 of the GTR #16. This is in line with the test “3.11 High speed performance test for passenger car tyres” where the test conditions reflect such variation.

#. [INSERT JUSTIFICATIONS FROM CASE BY CASE DOCUMENT (ETRTO TO PROVIDE)]

#. [INSERT JUSTIFICATION/RATIONALE OF CONTENT OF PROPOSAL IN TYREGTR-20-13 (RUSSIAN FEDERATION TO PROVIDE)] (see the next XX1 through XX6 below)

XX1. The Amendment No. 2 to UN GTR No. 16 addressed the harmonization of the tests applicable to LT/C tyres: Physical Dimensions Test and High Speed Test, so that they are introduced respectively in the revised Sections 3.20. and 3.16 of UN GTR No. 16.

XX2. For tyres with Speed Symbols below “Q” the Informal Working Group dealt with the Amendment No. 2 had concluded that the FMVSS 139 High Speed Test is more severe than the UN Regulation No. 54 Load/Speed Endurance Test, so that the first one was designated as the harmonized test for the entire population of LT/C tyres. It is represented in paragraph 3.16.1.

XX3. For tyres with Speed Symbols “Q” and above the Amendment No. 2 to UN GTR No. 16 had substituted the non-harmonized provisions of UN Regulation No. 54 by the new harmonized provisions of the modified Load/Speed Endurance Test method represented in paragraph 3.16.2.

XX4. Meanwhile the Informal Working Group dealt with the Amendment No. 2 had concluded that due to the high complexity in harmonizing the Endurance Test, the latter shall remain non-harmonised for the time being. The Informal Working Group had streamlined the GTR structure and included in the revised Sections 3.17. the two non-harmonized Endurance Tests as the two different options for transposition to the national/regional legislation of the Contracting Parties to the 1998 Agreement. Contracting Parties may select either option for the Endurance Test.

XX5. The first option represented in paragraph 3.17.1. is based on the provisions of FMVSS 139, and it is applicable for all LT/C tyres. This option consists of two tests: the Endurance test described in paragraph 3.17.1.1. and the Low inflation pressure performance test described in paragraph 3.17.1.2., which shall be performed in sequence, using the same tyre and rim assembly.

XX6. The second option represented in paragraph 3.17.2. is based on UN Regulation No. 54, which provisions allow to assess the performance of tyres by one combined Load/Speed Endurance Test. The test in this paragraph is applicable for tyres with Speed Symbols below “Q”, which are also subject for the High-Speed Test represented in paragraph 3.16.1. (see para. XX2. above). The performance of tyres with Speed Symbols “Q” and above with regard to endurance is verified by means of the modified Load/Speed Endurance Test represented in paragraph 3.16.2. (see para. XX3. above). Therefore those tyres are beyond the scope of paragraph 3.17.2.

#. The provisions for testing for high speed performances were harmonized. Provisions for high speed test for LT/C tyres based on FMVSS 139 and UN Regulation No. 54 were deleted. New harmonized provisions for high speed test for LT/C tyres (Delete previous 3.19 and 3.16, add new 3.16)].

#. The tyre industry completed a testing program to develop the harmonized high speed test, focusing the research on test load, test temperature and test inflation pressure as variables affecting test severity. The test data were evaluated by comparing the test steps in excess of regulatory limits that achieved under each set of

test conditions. This testing approach is the same as the approach used to develop the harmonized high speed test for passenger car tyres.

#. LT/C-type tires subject to the harmonized test are divided into three categories maximum test speeds as indicated : (1) tyres with speed symbols greater than or equal to S (final test speeds based on the speed symbol of the tyre); (2) tyres with R speed symbol (final test speed of 170 km/h (106 mph)); and (3) tyres with speed symbols less than or equal to Q (final test speed of 160 km/h (99 mph) regardless of marked speed rating).

#. The test temperature across all speed ratings for the harmonized high speed test is 35°C +/- 3°C. This test temperature is consistent with the test temperature in US FMVSS 139 and is higher (more severe) than the test temperature in UN Regulation No. 54 of 20°C to 30°C. The test duration is 60 minutes, consistent with UN Regulation N. 54, but 30 minutes shorter than FMVSS 139, which has a test duration of 90 minutes. In addition, the harmonized test eliminates the two-hour break-in and resulting cool down period that is present in the US FMVSS 139 test.

#. According to the results of the tyre industry testing program, for speed symbols greater than or equal to S, the modified UN Regulation No. 54 high speed test represented the most severe test. For speed symbols R and lower, the modified UN Regulation No. 54 high speed test was equivalent to the FMVSS 139 high speed test in terms of test severity. The modified UN Regulation No. 54 high speed test represents a more efficient test than the FMVSS 139 high speed test because it is of shorter duration, which impacts the capacity of testing facilities and reduces testing costs while representing a test that is comparable in terms of safety. Additionally, eliminating the break-in and cool down cycles further economizes laboratory resources without affecting test results. The results of the tyre industry testing program were accepted by the IWG without additional validation by a Contracting Party.

#. [Updates of the Annexes 3 and 6 with regard to the most recent developments in UN Regulations Nos. 30 and 54 (Annexes 3 and 6)] [PLACEHOLDER]

#. Addition of Annex 11 – Guidelines for Tolerances. This annex was added to provide contracting parties with guidance on potential compliance tolerances for various values in the technical prescriptions of this gtr. It is at the discretion of a contracting party whether and how tolerances are applied in its national regulations when transposing this gtr.