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Global Registry

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Addendum 23: United Nations Global technical regulation No. 23

United Nations Global Technical Regulation on the measurement procedure for two- and three-wheeled vehicles equipped with a combustion engine with regard to durability of pollution-control devices

Established in the Global Registry on 22 June 2022

Proposal and report pursuant to Article 6, paragraph 6.2.7. of the Agreement

- Authorization to develop a new UN GTR on durability of after treatment devices for two- and three- wheeled motor vehicles (ECE/TRANS/WP.29/AC.3/58)
- Final report on the development of Global Technical Regulation No. 23 (ECE/TRANS/WP.29/2022/107, adopted by AC.3 at its sixty-fourth session (ECE/TRANS/WP.29/1166, para. 187)



UNITED NATIONS

Authorization to develop a new UN GTR on durability of after treatment devices for two- and three- wheeled motor vehicles

I. Mandate and Objectives

1. In the framework of the 1998 Agreement and under continued work by the informal working group (IWG) on Environmental and Propulsion Performance Requirements of L-category vehicles (EPPR), the main objective of this proposal is to seek authorization for the EPPR IWG to develop a new UN GTR on the topic of *durability of after treatment devices for two- and three- wheeled motor vehicles*.
2. The IWG on EPPR will also consider aligning with the work done by the IWG on Worldwide harmonized Light Vehicles Test Procedure (WLTP) and if it is considered advantageous, to ensure harmonization and to avoid any duplication of effort.

II. Introduction

3. The IWG on EPPR was endorsed by the WP.29 at its November 2012 session (ECE/TRANS/WP.29/1099). The Executive Committee of the 1998 Agreement (AC.3) on its forty-fifth session (10-13 November 2015) adopted ECE/TRANS/WP.29/2015/113 (ECE/TRANS/WP.29/AC.3/36/Rev.1) whereby the European Union proposed changes to the proposal to develop amendments to UN Global Technical Regulation No. 2 and new regulations on environmental and propulsion performance requirements for light vehicles (ECE/TRANS/WP.29/AC.3/36). It was based on informal document WP.29-166-20, distributed at the 166th session (ECE/TRANS/WP.29/1116, para. 109). The mandate of the EPPR IWG was extended until December 2020.
4. The extension to a second working period (until December 2025) was requested by the EPPR IWG to the GRPE by asking for the endorsement of the Terms of Reference and rules of procedure for the informal working group on Environmental and Propulsion Performance Requirements of L-category vehicles (EPPR) (GRPE-81-23-Rev.1). The GRPE endorsed the EPPR IWG ToR in its 81st session (ECE/TRANS/WP.29/GRPE/81).
5. During the first mandate of the IWG on EPPR, the IWG has successfully completed the following technical regulatory texts (UN GTRs):
 - (a) UN GTR No. 17: "Global technical regulation on the measurement procedure for two- or three- wheeled motor vehicles equipped with a combustion engine with regard to the crankcase and evaporative emissions". Established in the Global Registry on 17 November 2016.¹
 - (b) UN GTR No. 18: "Global technical regulation on the measurement procedure for two- or three- wheeled motor vehicles with regard to on- board diagnostics". Established in the Global Registry on 17 November 2016.²
 - (c) UN GTR No. 2: "Global technical regulation on the measurement procedure for two-wheeled motorcycles equipped with a positive or compression ignition engine with regard to the emissions of gaseous pollutants, CO₂ emissions and fuel consumption - Amendment 4". Established in the Global Registry on 13 November 2019 ³

¹ <http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29registry/ECE-TRANS-180a17e.pdf>

² <http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29registry/ECE-TRANS-180a18e.pdf>

³ https://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29registry/ECE-TRANS-180a2am4e_for_submission.pdf

(d) Amendment 1 to UN GTR No. 18: "Global technical regulation on the measurement procedure for two- or three-wheeled motor vehicles with regard to on-board diagnostics". Introduction of OBD II⁴. It was adopted by WP.29 in its 182nd session (November 2020).

6. During the first mandate of the IWG on EPPR, the IWG also started to work on a new UN GTR on Durability testing of pollution control devices for two- and three- wheeled motor vehicles.

III. Areas of work

7. The EPPR IWG seeks from AC.3 the authorization to develop a new UN GTR on *durability of after treatment devices for two- and three- wheeled motor vehicles*. The IWG will use the initial work performed under the IWG first mandate.

8. The group shall focus its work in the following areas:

(a) Create a first consolidated draft of the UN GTR on durability based upon the European Union Regulation (see below) and incorporating those clauses from other existing regulation to obtain a highly harmonised technical regulation.

(b) The consolidated draft will be reviewed with the following objectives:

(i) Identify areas for further technical improvements;

(ii) Study the areas that need to be reviewed in order to adapt them to reflect regional needs.

(c) Finalising the draft and subsequently to present it for endorsement to the GRPE.

9. The EPPR IWG will keep GRPE informed on the status of the development of the new UN GTR, by periodical reports to GRPE.

IV. Existing regulations

10. The durability of after treatment devices for two- and three- wheeled motor vehicles is not currently regulated by any UN GTR or UN Regulation. It is known that the ability of components and systems to last is key to minimise the impact on the environment. Therefore, it is necessary to set up harmonised provisions for verifying that the durability requirements are met.

11. European Union regulations on environmental performance of two- or three-wheel vehicles and quadricycles (Reg. (EU) No. 168/2013 and its supplementing regulations⁵, the so-called Euro 5) provide test procedures and requirements for the durability of after treatment devices.

12. Japan addresses durability regulation in its "Enforcement procedure for motor vehicle type certification, Additional rule7: Durability driving enforcement procedure".

⁴ ECE/TRANS/WP.29/2020/129 and ECE/TRANS/WP.29/2020/130: Amendment 1 to UN GTR No. 18 (On-Board Diagnostic (OBD) systems for L-category vehicles) and its Technical Report.

⁵ COMMISSION DELEGATED REGULATION (EU) No 134/2014 of 16 December 2013 supplementing Regulation (EU) No 168/2013 of the European Parliament and of the Council with regard to environmental and propulsion unit performance requirements and amending Annex V thereof.

13. The United States Environmental Protection Agency addresses durability on its regulations for On Highway Motorcycles and deterioration factor determination with real world drive and emission tests⁶. It also considers durability in the case of light duty vehicles⁷
14. The People's Republic of China standards include Type V durability test addressing separately motorcycles and mopeds⁸.
15. The California Air Resources Board regulations on durability are contained in California Code of Regulations Title 13 Section 1958(c).
16. In the development of the UN GTR, the EPPR IWG will take into consideration the existing regulations to reach harmonized provisions for test procedures and requirements.

V. Timeline

17. The timelines proposed below for the new mandate are target timelines. The plan will be regularly reviewed and updated to reflect progress and feasibility of the timeline.
 - (a) January 2021: EPPR IWG presents timeline and framework for mandate request in GRPE;
 - (b) June 2021: Request for authorization submitted to AC.3;
 - (c) January 2021 – June 2021: EPPR IWG continues formulating and drafting UN GTR with elements agreed upon;
 - (d) June 2021: EPPR IWG provides an update to the June 2021 meeting of GRPE with a first draft (informal document) of the UN GTR for further discussion and recommendations;
 - (e) June 2021 – October 2021: EPPR IWG conclude the GTR and prepares a formal (working) document of the GTR to be submitted to the GRPE;
 - (f) January 2022: EPPR IWG presents the UN GTR to GRPE and ask for endorsement for consideration by WP.29 and AC.3.

⁶ 40 CFR Part 86 (86.419, 86.426, 86.427, and 86.432).

⁷ Emission Durability Procedures for New Light-Duty Vehicles, Light-Duty Trucks and Heavy-Duty Vehicles". January 17, 2006. 40 CFR Part 86, 71 FR 2809

⁸ GB 14622-2016 "Limits and measurement methods for emissions from motorcycles" and GB 18176-2016 "Limits and measurement methods for emissions from mopeds"

Final report on the development of UN GTR No. 23 on the measurement procedure for two- and three-wheeled vehicles equipped with a combustion engine with regard to durability of pollution-control devices

I. Mandate

1. The new UN Global Technical Regulation (GTR) on Durability was developed by the Informal Working Group (IWG) on Environmental and Propulsion Performance Requirements of L-category vehicles (EPPR). The Executive Committee (AC.3) of the 1998 Agreement adopted the authorization to develop a new UN Global Technical Regulation (UN GTR) on the topic of durability of after treatment devices for two- and three-wheeled vehicles at its June 2021 session (ECE/TRANS/WP.29/AC.3/58).

II. Objectives

2. The main objective of the above authorization is to develop requirements and/or test procedures under the 1998 Agreement and to create synergies with the 1958 Agreement UN Regulations on the topic of durability of after treatment devices for two- and three-wheeled vehicles. Where possible, to develop common requirements in the form of one or more UN Regulations and one or more UN GTRs, as well as associated amendments and/or supplements.

3. The discussion started from the harmonization of the test procedures for two-wheeled vehicles equipped with conventional combustion engine technology, and finally included three-wheeled vehicles, both also with alternative fuel technology.

4. The scope of discussions did not cover four-wheeled vehicles.

5. The IWG on EPPR focussed its work in the following areas:

(a) Create a first consolidated draft of the UN GTR on Durability based upon the European Union Regulation (see below) and incorporating those clauses from other existing regulation to obtain a highly harmonized technical regulation.

(b) Review the consolidated draft with the following objectives:

(i) Identify areas for further technical improvements.

(ii) Study the areas that need to be reviewed in order to adapt them to reflect regional needs.

(c) Finalise the draft and subsequently present it for endorsement to the WP.29.

III. Technical rationale

A. Introduction

6. The industry producing two- and three-wheeled vehicles in the scope of this United Nations Global Technical Regulation (UN GTR) is a global one, with companies selling their products in many different countries. The Contracting Parties to the 1998 Agreement have determined that work should be undertaken to address the environmental performance requirements from two- and three-wheeled vehicles of category 3 as a way to help improve air quality internationally.

7. The aim of this UN GTR is to provide measures to strengthen the world-harmonization of light motor vehicle approval and certification legislation, in order to improve the cost effectiveness of environmental performance testing, remove trade barriers,

reduce the overall complexity of global legislation, remove potential areas of conflict or opposing requirements and improve the air quality.

8. In the framework of the 1998 Agreement and under continued work by the Informal Working Group (IWG) on Environmental and Propulsion Performance Requirements of L-category vehicles (EPPR), the objective of this document is to propose a new UN GTR on the measurement procedure for two- and three-wheeled vehicles equipped with a combustion engine with regard to durability of pollution-control devices.

9. The IWG on EPPR also considered alignment with the work done by the IWG on Worldwide harmonized Light Vehicles Test Procedure (WLTP) if deemed advantageous, to ensure harmonization and to avoid any duplication of effort.

10. This UN GTR is based on the work of the IWG on EPPR, which held its first meeting during the sixty-fifth GRPE in January 2013 and on the initial proposal by the European Union (EU, represented by the European Commission (EC)).

B. Procedural background

11. The EU put forward and announced their intention of setting up a working group during the sixty-third and sixty-fourth meetings of GRPE in January and June 2012 and in the 157th session of WP.29 in June 2012.

12. The authorisation to develop the above UN GTR was requested at the 62nd session of GRPE in January 2021 with document number GRPE-82-26-Rev.1, which was submitted for adoption to the 184th session of WP.29 in June 2021 as document number ECE/TRANS/WP.29/2021/81.

13. At the 85th GRPE session in January 2022, a formal proposal for this new UN GTR was tabled for adoption (ECE/TRANS/WP29/GRPE/2022/7). Subsequently the proposal was prepared for submission to the June 2022 session of WP.29 for adoption by the Executive Committee of the 1998 Agreement (AC.3).

14. Ongoing developments of test types and procedures and global discussion on harmonization have resulted in the technical requirements contained within this UN GTR. The final text of the UN GTR is presented in section II of this document.

C. Regulations and international voluntary standards referenced

1. Technical references in the development of this UN GTR

15. For the original development of this UN GTR on Durability of pollution control devices, the following legislation and technical standards on Test Type V contained relevant applications of requirements for light vehicles which were available for technical reference:

(a) UNECE:

(i) 01 series of amendments to UN Regulation No. 40 (Uniform provisions concerning the approval of motorcycles equipped with a positive-ignition engine with regard to the emission of gaseous pollutants by the engine).

(ii) 07 series of amendments to UN Regulation No. 83 (Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements)

(b) China:

(i) GB 14622-2016 "Limits and measurement methods for emissions from motorcycles (CHINA IV);

(ii) GB 18176-2016 "Limits and measurement methods for emissions from mopeds (CHINA IV).

- (c) EU:
 - (i) Regulation (EU) No. 168/2013 adopted in the course of 2013, amended by Regulation (EU) No. 2019/129 and Regulation (EU) No. 2020/1694, as well as the delegated act on environmental and propulsion unit performance requirements.
 - (ii) Regulation (EU) No. 134/2014 (REPPR) , amended by Regulation (EU) No. 2016/1824 and Regulation (EU) No. 2018/295, setting out technical provisions and environmental performance test procedures.
- (d) India:
 - (i) MoSRT&H/ CMVR/ TAP-115/116, Central Motor Vehicle Rule No. 115 and AIS 137 Part 1;
 - (ii) Government of India Gazette Notifications: GSR 889 (E) dt. 19.09.2016 and GSR 881 (E) 26.11.2019.
- (e) Japan:
 - (i) Road vehicle Act, Article 41 "Systems and Devices of Motor Vehicles";
 - (ii) Safety Regulations for Road Vehicles, Article 31 "Emission Control Devices";
 - (iii) Enforcement procedure for motor vehicle type certification, additional rule7 on "Durability driving enforcement procedure".
- (f) United States of America:
 - (i) US Code of Federal Regulations (CFR) Title 40, Part 86 Subpart E&F;
 - (ii) California Air Resources Board regulations on durability as contained in California Code of Regulations Title 13 Section 1958(c).
- (g) ISO standards:
 - (i) ISO 11486 (Motorcycles - Chassis dynamometer setting method);
 - (ii) ISO 4164 (Mopeds — Engine test code — Net power);
 - (iii) ISO 4106 (Motorcycles -- Engine test code -- Net power).
 - (iv) ISO 7116 (Mopeds — Measurement method for maximum speed)
 - (v) ISO 7117 (Motorcycles — Measurement method for maximum speed)

16. Most of these regulations had been in existence for many years and the methods of measurement varied significantly. The technical experts were familiar with these requirements and discussed them in their working sessions. The IWG on EPPR therefore considered that to be able to determine a two- and three-wheeled vehicle's real impact on the environment, in terms of its exhaust pollutant emissions and energy efficiency, the test procedure and consequently the UN GTR No. 2 needs to represent modern, real-world vehicle operation.

IV. Development of Durability UN GTR

A. Issues

17. Amendment 5 to UN GTR No. 2 brings together the tailpipe pollutant and CO2 emissions related Test Types I, II and VII and is supplemented by this UN GTR regarding the durability requirements of pollution control devices.

18. At the time of creation of the original version of UN GTR No. 2, durability requirements (Test Type V) were outside the scope of the WMTC informal group's

mandate. However, Contracting Parties were expressly permitted within this section to specify durability requirements and/or useful life provisions in their national or regional legislation in relation to the emission limits set out in UN GTR No. 2. This UN GTR on Durability introduces a harmonized testing procedure for the durability of pollution control devices of light motor vehicles (Test Type V) in order to supplement the environmental performance requirements laid down in Amendment 5 to UN GTR No. 2. Important elements identified for the global harmonization of Test Type V were:

- (a) driving schedules;
- (b) test vehicle requirements;
- (c) test mileages;
- (d) procedures for verifying durability with reduced mileage accumulation;
- (e) frequency and conduct of Type I emissions tests.
- (f) the reference to one world harmonized Test Type I (WMTC) to verify tailpipe emissions during and after completion of mileage accumulation to compare them with the emission limits set out in the Amendment 5 to UN GTR No. 2;
- (g) provisions covering modern powertrain configurations, e.g. hybrid-electric powertrains.

B. Applicability

19. The IWG on EPPR followed the agreed terms of reference and has prepared a UN GTR for motor vehicles in the scope of this UN GTR under the 1998 Agreement as well as two- and three-wheeled vehicles under the 1958 Agreement. In accordance with the agreed terms of reference, UN GTRs and Regulations in the area of EPPR will be developed as much as possible in a coherent way.

C. Scope

20. The IWG on EPPR has discussed at length which vehicle types should be in the scope of the UN GTR. One of the objectives of the group was to discuss the substantive requirements of two-wheeled vehicles first followed by a discussion if these requirements should as well be applied to three-wheeled vehicles. In particular it was debated whether or not the classification criteria laid down in paragraph 2. of Special Resolution No. 1 (S.R.1) on category 3 vehicles should be referenced in detail or using a more generic wording, e.g. two- and three-wheeled vehicles allowing for more flexibility to allow alignment with domestic classification of three-wheeled vehicles.

21. The IWG on EPPR discussed possible solutions how three-wheeled vehicles could be included in the scope of the UN GTR given the fact that S.R.1 contains recommended classification criteria for category 3 vehicles that might require an update for technical progress. Finally it was agreed to put "category 3" vehicles in paragraph 2. of the UN GTR, to reference S.R.1 in a footnote and to state the following with respect to the classification of a three-wheeled vehicle:

"With regard to a three-wheeled vehicle of category 3-4 or 3-5, Contracting Parties agree that at a minimum the following criteria should be taken into account for vehicle classification:

- (a) In their straight-ahead condition, motor vehicles having two wheels which are placed on the same straight line and equipped with one sidecar; or
- (b) Motor vehicles having a saddle-type seat, a handle-bar type steering system and three wheels, on which the side of the driver's seat is of open structure."

22. Contracting Parties may expand the scope to other types of three-wheeled vehicles in order to align with their domestic classifications of three-wheeled vehicles as deemed appropriate.

D. Definitions

23. The definitions used in the UN GTR are aligned as much as possible with definitions in international legislation and from the work of the Vehicle Propulsion System Definitions (VPSD) group operating under GRPE with the goal to harmonize high level powertrain definitions as well as from other regional legislation as listed in chapter C.1.

E. Requirements

24. For Test Type V, the UN GTR contains:

(a) three different durability test procedures at the discretion of the manufacturer: actual durability testing with full mileage accumulation, actual durability testing with partial mileage accumulation and a mathematical durability procedure;

(b) two alternative driving schedules for mileage accumulation are included, including soak procedures, at the discretion of the manufacturer:

(i) the Standard Road Cycle (SRC-LeCV) on the basis of the WMTC; and

(ii) the Approved Mileage Accumulation Cycle (AMA); see supplementary information in US CFR Title 40, Part 86 for background information;

(c) test mileages split into principal requirements that fulfil the requirements of all Contracting Parties and alternative requirements that allow Contracting Parties to accept reduced mileage for their regions;

(d) the Standard Bench Cycle shall be run for the period of time calculated from the BAT equation. The SBC is described in Annex 4.

(e) clarifications on the conduct and frequency of Type I emissions tests and compliance criteria for the three testing procedures.

F. Performance Requirements

25. Test Type V is a mix of mileage accumulation according to a prescribed test cycle and tailpipe emission verifications during and at the end of mileage accumulation according to the Test Type I requirements. Alternatively, Test Type V is the result of multiplying Test Type I results by a DF factor. Two- and three-wheeled vehicles shall during and after completion of Test Type V meet the performance criteria laid down in paragraph 7. of Amendment 5 to UN GTR No. 2.

G. Market Fuel and Reference Fuel

26. With respect to Test Type V, the IWG on EPPR considered to use representative market fuel for mileage accumulation and representative reference fuel for Test Type I verification testing. The IWG on EPPR decided to use the same market fuels and reference fuels as the ones in Amendment 5 to UN GTR No. 2. For mileage accumulation, the commercially available fuel to be used is specified in paragraph 6 of Annex 5 to this UN GTR, and the reference fuel for Type I test shall be one of those specified in Appendix 2 to Annex 4 of Amendment 5 to UN GTR No. 2.

27. The principal performance requirements introduced in paragraph 7. of Amendment 5 to UN GTR No. 2 are based on the use of the reference fuel as specified in Appendix 2 to Annex 4 of Amendment 5 to UN GTR No. 2. The use of this standardised reference fuel for determining compliance with the principal emission limits set out in paragraph 7. of Amendment 5 to UN GTR No. 2 is considered as an ideal condition for ensuring the reproducibility of regulatory emission testing, and Contracting Parties are encouraged to use such fuel in their compliance testing.

28. Contracting Parties may continue using reference fuels currently in use in their countries for the principal performance requirements in paragraph 7. of Amendment 5 to

UN GTR No. 2 on condition that their equivalence with the reference fuel in Appendix 2 to Annex 4. of Amendment 5 to UN GTR No. 2 in terms of emissions is demonstrated.

29. The alternative performance requirements in paragraph 7. of Amendment 5 to UN GTR No. 2 are applicable with the corresponding reference fuels.

H. Regulatory impact and economic effectiveness

30. Anticipated benefits.

Increasingly two- and three-wheeled vehicles are being prepared for the world market. To the extent that manufacturers are preparing substantially different models in order to meet different emission regulations and methods of measuring CO₂ emission and fuel or energy consumption, testing costs and other production values are increased. It would be more economically efficient to have manufacturers using a similar test procedure worldwide wherever possible to prove satisfactory environmental performance before placing a product on the market. It is anticipated that the test procedures in this UN GTR will provide a common test programme for manufacturers to use in countries worldwide and thus reduce the amount of resources utilised to test vehicles. These savings will accrue not only to the manufacturers, but more importantly, to the consumers and the authorities as well. However, developing a test programme just to address the economic question does not completely address the mandate given when work on this UN GTR was first started. The test programme also improves the state of testing vehicles, reflects better how vehicles are used today and covers recent and near-future powertrain technologies, fuels and emission abatement technologies.

I. Potential cost effectiveness

31. At the time of writing this UN GTR, the data is not available to undertake a full impact assessment of the test types contained. This is in part because not all limit values have been set out and it is undecided to what level the proposed upgrade of test procedures will be accepted by Contracting Parties. Specific cost effectiveness values can be quite different, depending on the national or regional environmental needs and market situation. While there are no calculated values here, the belief of the technical group is that there are clear and significant benefits comparing to justifiable, anticipated cost increases associated with this UN GTR. Finally allowing not only all two- but also three- wheeled vehicles to be tested according to a dynamic, real-world emission laboratory test-cycle will much better reflect the actual environmental performance of light motor vehicles including pollutant emissions and energy efficiency measurement results, allowing the gap between claimed and actual, real-world environmental performance experienced by citizens to be narrowed.

V. Specific issues on Durability UN GTR

A. Categories in the scope

32. The IWG on EPPR provided extensive consideration which categories of motorcycles and mopeds — referred to as L-category vehicles under the 1958 Agreement — should be included in the scope of this UN GTR.

33. Japan initially proposed to refer to two-wheeled vehicles only, as a procedure existed to test them in UN GTR No. 2 (Amendment 4 being limited only to two-wheeled vehicles). Following up on the request by India to develop a test procedure for three-wheeled vehicles and by EC and US to include also three-wheeled vehicles as already implemented in their national regulations, IMMA developed a proposal to extend the scope of UN GTR No. 2 also to three-wheeled vehicles (in Amendment 5), thus opening up the possibility to extend also the scope of this UN GTR on Durability to such categories of vehicles. Provided extension of UN GTR No. 2 to three-wheeled vehicles, Japan could then also accept extension of this UN GTR to three-wheeled vehicles.

34. China also agreed to extend the scope of this UN GTR to three-wheeled vehicles.
35. Since all reservations were lifted, it was finally agreed to also include the type of three-wheeled vehicles described in Euro 5 into this UN GTR, taking also into account the proposal by IMMA to include three-wheeled vehicles in Amendment 5 to UN GTR No. 2, which was in development at that same moment in time, in order to keep the two GTRs aligned.
36. Regarding four-wheeled vehicles (L6, L7), considering that such expansion of scope was not scheduled for UN GTR No. 2 and that the scope of GTR17 did not include them but included up to three-wheeled vehicles (L1, L2, L3, L4, L5) only, Japan proposed this addition to be optional for Contracting Parties.
37. Contracting Parties decided not to include four-wheeled vehicles.
38. Conclusion: two- and three-wheeled vehicles are in the scope.
39. Since UN GTR No. 2 introduced the possibility to use Class 0 as CP option, it was agreed to add this option also in the new UN GTR on Durability, as proposed by Japan.

B. Fuels in the scope

40. With respect to Test Type V the IWG on EPPR considered to use representative market fuel for mileage accumulation and representative reference fuel for Test Type I verification testing.
41. The IWG on EPPR provided extensive consideration the types of fuel to be included in the scope, on whether it should be solely the traditional gasoline and diesel or also include alternative fuels.
42. Japan initially proposed to consider the same fuels as in the then current version of UN GTR No. 2 (Amendment 4), which were gasoline and diesel. Following up on the request by India and EC to include also alternative fuels, and the EC proposal for a compromise on adding them as CP option, Japan agreed to accept them if other CP requested their introduction, provided that they were included in the scope of UN GTR No. 2 in parallel. The IWG on EPPR finally agreed to include alternative fuels both in the upcoming Amendment 5 to UN GTR No. 2 and in the Durability GTR as CP option.
43. Conclusion: The inclusion of gasoline, diesel and, as CP option, alternative fuels were agreed upon. The fuels used in this UN GTR on Durability were aligned with those of Amendment 5 to UN GTR No. 2. The alternative fuels are specified in Appendix 2 to Annex 4 of GTR No. 2 Amendment 5.
44. For reference fuel, Japan proposed to allow, as an option for Contracting Parties, the use of alternative fuels specified in UN GTR No.2 Amendment 5, similarly to the WLTP-GTR No.15 requirements; see DUR-10-01. The IWG on EPPR agreed.
45. The IWG on EPPR decided to use the same market fuels and reference fuels as the ones in Amendment 5 to UN GTR No. 2. For mileage accumulation, the market fuel to be used is specified in para 6. of Annex5 to this UN GTR, and the reference fuel for Type I test shall be one of those specified in Appendix 2 to Annex 4 of Amendment 5 to UN GTR No. 2.
46. The principal performance requirements introduced in point 7. of Amendment 5 to UN GTR No. 2 are based on the use of the reference fuel as specified in Appendix 2 to Annex 4 of Amendment 5 to UN GTR No. 2. The use of this standardised reference fuel for determining compliance with the principle emission limits set out in point 7. is considered as an ideal condition for ensuring the reproducibility of regulatory emission testing, and Contracting Parties are encouraged to use such fuel in their compliance testing.
47. Contracting Parties may continue using reference fuels currently in use in their countries for the principal performance requirements in point 7. on condition that their equivalence with the reference fuel in Appendix 2 to Annex 4. of Amendment 5 to UN GTR No. 2 in terms of emissions is demonstrated.

48. The alternative performance requirements in point 7. of Amendment 5 to UN GTR No. 2 are applicable with the corresponding reference fuels.

C. Test procedures

49. The IWG on EPPR agreed to keep all four alternative test procedures currently specified in Euro 5:

- (a) Actual durability testing with full mileage accumulation
- (b) Actual durability testing with partial mileage accumulation
- (c) Mathematical durability test procedure with fixed deterioration factors; see below
- (d) Bench ageing durability test.

D. Test procedure with mileage accumulation

50. When discussing DUR-13-01, Line 75, US Environmental Protection Agency (EPA) noted that, for larger vehicle, AMA was no longer allowed since SRC would be more representative.

51. Chair clarified that, even if EURO5 had been taken as basis, the GTR needed to include other area of harmonization with other regions.

52. EC had no objection in keeping "or" for the sake of clarity. Since there was no objection, it was agreed to keep "SRC-LeCV or AMA" for the mileage accumulation durability cycle.

E. Minimum Durability Mileage Accumulation

53. The IWG on EPPR has thoroughly evaluated the values of Table 2 (former Table B.2.-1) about Minimum Durability Mileage Accumulation, i.e. the minimum values which the CP can use for their domestic regulations.

54. US informed that US EPA and CARB wanted domestically to harmonize the accumulated mileage with Euro 5. However, from a study conducted by CARB, it had been found that these values were too low for some categories. It was thus anticipated that CARB might propose higher values for their own regulation. Establishing these values as minimum would allow a party to set higher values, not lower.

55. At EPPR-44 (April 2021), US presented their comments as in DUR-14-02 (USA), proposing to use the same requirements for two- and three-wheeled vehicles, as in US, and to simplify the table accordingly. China presented their comments as in DUR-14-05; in China IV durability mileage of two- and three-wheeled vehicles was different, in order to keep it consistent with Euro 4. In China V, which was still under discussion, China was considering merging the durability mileage of two- and three-wheeled vehicles. China could agree with the US proposal to use the same requirements for two- and three-wheeled vehicles. EC, India and IMMA raised a study reservation on the USA proposal. IMMA presented DUR-14-03 and DUR-14-04.

56. At EPPR-46 (June 2021), following presentation were discussed again: DUR-14-02 (USA) 3wheelers DUR Distance Accumulation Mileage.pptx proposing to use the same requirements for two- and three-wheeled vehicles, as in US, and to simplify the table accordingly. DUR-14-05 (China) Durability mileage accumulation of 2-wheelers and 3-wheelers.pptx in China IV, durability mileage two- and three-wheeled vehicles was different, in order to keep it consistent with Euro 4. In China V, which was still under discussion, China was considering merging the durability mileage of two- and three-wheeled vehicles. Finally, US presented a revised version of the China's overview DUR-16-01 on Deterioration Factors: see DUR-16-05 (US EPA).

57. At EPPR-47 (Jul 2021), China presented DUR-17-06, among other setting higher values (i.e. longer mileage) for high-performance three wheeled vehicles.

58. At EPPR-48 (Aug 2021), after evaluation of proposals US DUR-17-05 by US EPA, DUR-17-06 r1 by China and DUR-18-02 by IMMA, upon Chair's proposal it was agreed to keep the UN GTR as much as possible aligned to Euro 5 at that stage of discussion, i.e. as in the IMMA proposal DUR-18-02 in this first version of the UN GTR and to then resume discussion to update the table in the future; e.g. considering inclusion of 35000 km for high-performance vehicles as proposed by China and considering inclusion of low-performance three wheeled vehicles as proposed by India.

59. Conclusion: Table 2 (former Table B.2.-1) was agreed as in the proposal DUR-18-02.

F. Mathematical test procedure with fixed DF

60. After thorough evaluation, the IWG on EPPR agreed to keep the mathematical test procedure with fixed deterioration factors (DF) as an alternative test procedure at CP option, as proposed by India and China.

61. EU had decided to phase out the mathematical test procedure as from 1 January 2025 in Article 23-3(c) of Regulation (EU) No 168/2013, as amended by Regulation (EU) No 2019/129. This decision would apply to all EU Countries. EC could accept it as CP option in the UN GTR, while noting that such option would no longer be available in the EU after 2024. Japan had not yet decided about its implementation at national level at the time of developments of the UN GTR. India indicated that the fixed DF in China were slightly different from the one in Euro 5 (and thus in the current draft UN GTR) and kindly requested China to provide some data to explain their experience and consequently their choice of fixed DF. China deemed not necessary to provide definite DF in a UN GTR. The UN GTR might leave CPs free to specify their own fixed DF, according to their national needs.

62. In EPPR-43 (March 2021), the EC confirmed phasing out the mathematical procedure as from 1 January 2025. EC would thus prefer to delete that option, if no CPs was planning to use it. IMMA proposed to keep that option in the UN GTR, for any potential future CP to the 1958 Agreement, e.g., possibly from ASEAN Countries. India agreed with IMMA in keeping that option. Since DF were regularly published in US, US EPA proposed to use US EPA-data to review such factors in the future. US EPA encouraged also other CPs to share their data, if available.

63. Conclusion: The mathematical test procedure with fixed DF was kept as CP option, for regions who wanted to use them.

G. Deterioration Factors (DF)

64. The IWG on EPPR also evaluated whether necessary to update the multiplicative DF proposed on the basis of the Euro 5 regulation, as requested by the US EPA and China.

65. The values have been derived from a study by EMISIA on the implementation of Euro 5 for L-Cat. For the specific case of three-wheeled vehicles, the study had reviewed the useful life of L5 vehicles concluding it is of ca. 41250km, so higher than the 20000km durability requirements. However, the study had noted that L5 vehicles could have very different useful life mileage depending on the use made: transport of passenger designed vehicles reach higher mileages than the one designed to transport goods. The study had concluded that there was no data to support an increase of durability requirements for L5 vehicles. See Paragraph 7.10 in: <https://op.europa.eu/en/publication-detail/-/publication/f3f268fc-943f-11e7-b92d-01aa75ed71a1/language-en>.

66. EC noted the lack of more recent studies on multiplicative DF for Euro 5, as it would not be used anymore after 2024.

67. US EPA and China showed some more recent statistical analysis of DF:

- (a) DUR-14-06 (US EPA)
- (b) DUR-03-01 (China)
- (c) DUR-14-05 (China)

68. At EPPR-46 (June 2021), India noted that:

(a) DF based on mathematical durability procedure was a CP option and therefore the text should be left unchanged.

(b) There should be no sunset provision, so that CP having started regulating this procedure should not be forced to change it during their law-making process.

EC did not oppose presenting the mathematical durability procedure as a CP option.

EC would like to understand whether CPs preferred to leave DF fixed or open.

IMMA proposed to set DF out as in Table 7 Alt B in UN GTR No. 2.

Remarking that DF had not been set on Euro5 for L-category vehicles but on earlier Euro-level, US EPA proposed the following:

(a) To keep §2.5.1., including "Contracting Parties may require the alternative multiplicative deterioration factors according to their durability legislation";

(b) To add: "CP must supply study information/data to support their choice for DF."

69. Note: Regulation (EU) No 168/2013 indicates in Annex VII (B) both DF for Euro 4 and Euro 5.

70. At EPPR-47 (July 2021), US EPA presented DUR-17-05, slide 3, and mentioned the background data in slides 4-6, proposing, among others, to change the text so as to allow CPs to choose domestically greater values/higher minimum mileages than the ones defined in the UN GTR.

71. Chair noted that values in Table 4 and 5 should be considered as the minimum acceptable for the DF. The CPs should be allowed to increase these values if they wanted, referring to the individual US (DUR-14-06) and China (DUR 03-01) submittals showing greater values than the one used in Euro 5. Accepting larger values in the GTR would go against harmonization. He invited the IWG on EPPR to reflect on how to avoid another CP option, for the sake of harmonization.

72. MECA deemed that harmonization should set the highest values in the GTR, while CPs could choose lower values, which would however only be valid locally.

73. China agreed with US that DF should be higher than in EU and thus called for keeping them as CP option.

74. Chair expressed the understanding for the US and China's call for larger values, noting that this would however go against harmonization.

75. US EPA noted that the Euro 5 values for DF were not based on vehicle aging testing of Euro 5 vehicles but came from data from 2009 and 2014 (ref: "Table 2 Matching of 2009 and 2014 KBA databases by category" in the JRC Phase 1 of the Environmental Effect Study on the Euro 5 step of L-category vehicles (Page 10)), while data from US (DUR-14-06) and China (DUR-03-01) were more recent.

76. IMMA strongly supported Chair's view to strive for harmonization, limiting the CP options as much as possible. The IWG on EPPR had fundamentally agreed to align this UN GTR as much as possible to Euro 5. The Euro 5 had based its value on extensive tests and investigation, while the more recent and on-going research shown by other CPs had not yet reached that extent. He invited the IWG on EPPR to use the Euro 5 values for this basic UN GTR, while leaving the possibility open to review these values in the next stage, when more data and strong justification was available.

77. In view of reaching harmonization, Chair welcomed the proposal for compromise made by IMMA.

78. The Secretary noted that the background of any decision going in this sense could be documented in the Technical Report.
79. Japan and India agreed with the IMMA proposal.
80. China was currently conducting a China 5 study on Euro5 emission level vehicles. China would need more time with the plan to finalise it in roughly one year from now.
81. US could accept the proposal to review the values in 2022. The US would pull the publicly available deterioration factor from the online EPA Annual Certification Database for Vehicles, Engines and Equipment, at that time and present alongside China.
82. MECA called upon avoiding to delete DF from the UN GTR in the future, based on the reason that EU was going to abandon them as from 2024.
83. EC stated that, if DF (mathematical) were deemed a valid tool, the EC will agree in keeping them in the UN GTR on Durability.
84. US changed their proposal which, after some further comments, read as follows:
"2.5.1. At the option of the Contracting Party, as an alternative to paragraph 2.3.1. or 2.3.2., the manufacturer may request to use the mathematical durability procedure laid down in paragraph 2.3.3. The multiplicative deterioration factors for the mathematical durability procedure are set out in Table 4."
85. The additional recommendations by the US in slide 3 could not be taken over. As noted by the Chair, UN GTR No. 2 Amd5 could not make reference to UN GTR on Durability, since the latter had not yet been finalized and published.
86. The US (and former IMMA) proposal to delete Table 6 in para. 2.5.4 was not discussed explicitly but, since no alternatives were set and the table was empty, it was considered accepted.
87. Conclusion: It was agreed to keep UN GTR on Durability aligned with Euro5, since still used in many CPs, and to resume discussion on updated DF in a further step of activities, when more data and solid study could be presented by CPs (e.g. US, China).
88. At the request of US EPA, it was also agreed to add document DUR-18-01 (US EPA), which read as follows.
89. US Statement on multiplicative deterioration factors (DUR-18-01):
- (a) In the course of development of this GTR, the US EPA asked to add following comments to the Technical Report accompanying the UN GTR on Durability, on controversially discussed subjects in the area of the durability procedure for two- or three-wheeled vehicles with regard to multiplicative deterioration factor values. Compromises and decisions taken by the IWG on EPPR
- (b) A number of subjects within the draft UN GTR on Durability led to discussions within the IWG on EPPR and the different views and positions among the participants were debated at length. For the largest share of these more difficult subjects a compromise could be worked out; for one subject the IWG on EPPR decided to postpone the discussion and to reopen the debate at a later point in time when more scientific evidence is collected and available for assessment: The topic of multiplicative deterioration factors, which were discussed in both UN GTR on Durability and UN GTR No. 2. The values of concern were listed in UN GTR No. 2 as they were removed from inclusion in the UN GTR on Durability for the final draft. The controversially discussed subject, the associated references, the data provided and to be provided, and decisions by the IWG on EPPR are the following:
- (c) Multiplicative deterioration factor development for UN GTR No. 2, and referenced in UN GTR on Durability, based on Euro5 emission level vehicles and multiplicative deterioration factors:
- (i) Despite fundamental differences in opinion among the IWG on EPPR members on objectives, the use and applicability of the UN GTR on Durability, solutions were found that are satisfactory for the parties involved. It was possible to

find wording that allows the Contracting Parties to harmonize Durability requirements to the largest extent possible and to apply it for the purposes needed. In several sessions the debate was held in the IWG on EPPR meetings regarding the justification of the values chosen for the multiplicative deterioration factors for two- and three-wheeled vehicles, listed in Section 7 (Performance requirements for the Test Type I of a two- and three- wheeled vehicle) of UN GTR No. 2 to which the UN GTR on Durability references.

(ii) Traditionally, information in Euro5 regulations providing the basis for these UN GTRs have exclusively served the purpose of environmental protection with an associated rationale and practical implementation. The reference for the multiplicative deterioration factors in the Euro5 regulation are as follows:

" (1) Euro5: Annex VII of Regulation EU No. 168/2013 contains a table titled "Durability of pollution control devices" which includes (A) Durability mileage of L-category vehicles and (B) Multiplicative deterioration factors (DF)"

(2) Article 23 of Reg 168/2013 states:

"

c. mathematical durability procedure ¹:

....

4. By 1 January 2016, the Commission shall carry out a comprehensive environmental effect study. The study shall evaluate the air quality and the share of pollutants contributed by L-category vehicles and shall cover the requirements of Test Types I, IV, V, VII and VIII listed in Annex V.

It shall collate and evaluate the latest scientific data, scientific research findings, modelling and cost efficiency with a view to establishing definitive policy measures by confirmation and final establishment of the Euro 5 enforcement laid down in Annex IV and the Euro 5 environmental performance requirements] laid down in Annexe V, in Annex VI (A2), (B2) and (C2) and in Annex VII concerning Euro 5 durability mileages and deterioration factors.

Ref: Regulation (EU) No 168/2013 of the European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheeled vehicles and quadricycles (Text with EEA relevance) (legislation.gov.uk)"

(3) The 2016 JRC Effect Study performs the evaluation per Article 23 of Reg 168.

a. The 2016 JRC Effect Study contains the following "2.2 Data mining of Test Type I values related to L-category vehicles Information related to type approval from L-category vehicles were collected from the German Federal Motor Transport Authority (Kraftfahrt- Bundesamt KBA). In compliance with EC Directive 2003/4/EC, the KBA publishes regularly these values to ensure public access to information linked to environmental matters [9]. Two databases were obtained from the KBA, representing the state of play of regulated emissions in 2009 and 2014 [10,11]. These databases provided CO2 emission, fuel consumption and emission type test values for new vehicles with general operating licence or EC type approval sold in the German market. Please note that the KBA provides type approval data, not emission values from in-use vehicles. For an overview of emissions from in-use L-category

¹ <https://www.legislation.gov.uk/eur/2013/168/body#commentary-c000002>

vehicles refer to Adam et al. [12], Clairotte et al. [13], Zardini et al. [14], Platt et al. [15], and references therein."

b. The references for in-use vehicles in paragraph a. above are from 2009-2014 and refer to several two stroke scooters and one four stroke scooter. The reference vehicles were not based on engines that met Euro5 emission standards. No other reference to the in-use studies were included in the 2016 Effect Study.

(d) In order to allow the IWG on EPPR to fully evaluate the deterioration factors used for vehicles meeting UN GTR No. 2/Euro5 vehicle level exhaust emissions, additional tailpipe emission deterioration data will be provided by China and the US EPA in 2022. The IWG on EPPR will, shortly thereafter, consider the information provided for developing new multiplicative deterioration factors for two- and three- wheeled vehicles in 2025 and beyond.

(i) Deterioration factor data have already been provided to the IWG on EPPR by China in 2020 (China 4 study, Euro4, DUR 03-01) and the US EPA in 2021 (analyses of publicly available deterioration information of near Euro5 emission level engine families provided in US EPA's Annual Certification Database, DUR 14-06). Both sources of information show how the deterioration factors are higher than those currently included in Annex VII of Regulation EU No. 168. China and the US are of the opinion that new deterioration factors should be determined based on data of Euro5 compliant vehicles for use in 2025 and beyond. This will allow harmonization of Amendment 5 to UN GTR No. 2 and UN GTR on Durability with Euro5 thru 2024 and then utilizes Euro5 emission level determined multiplicative deterioration factors from 2025 and beyond.

(ii) Additional deterioration factor information will be provided by China (China 5 study, on Euro5 compliant vehicles) and the US EPA (EPA 2021 certification DF data from motorcycles) in 2022.

H. Replacement pollution-control devices

90. After thorough evaluation, the IWG on EPPR decided to include replacement pollution-control devices in the UN GTR after removing the administrative provisions.

91. The inclusion of Annex 6 on replacement devices in the UN GTR - instead of directly specifying that the pollution control device should be replaced with original certified/type approved equipment - may put at risk some of the originally designed features of the vehicle (i.e. noise, performance, etc.). However, recognizing the specificities of the Motorcycle market, Association for Emissions Control by Catalyst (AECC) recommended to keep such Annex in the UN GTR, as this shall require any replacement part supplier to test their devices at similar level of stringency as original equipment.

92. AECC made also reference to European Regulation (EU) No 168/2013 on the approval and market surveillance of two- or three-wheeled vehicles and quadricycles, Article 23 Paragraph 10, where there are already provisions for replacement devices: "Manufacturers shall ensure that allow replacement pollution control devices placed on the market or at the entry into service in the Union, are type-approved in accordance with this Regulation."