



**Economic and Social
Council**

Distr.

GENERAL

TRANS/WP.29/GRB/26
2 April 1998

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

INLAND TRANSPORT COMMITTEE

Working Party on the Construction of Vehicles

Meeting of Experts on Noise

REPORT OF THE MEETING OF EXPERTS ON NOISE
ON ITS TWENTY-EIGHTH SESSION
(23 to 26 February 1998)

1. The Meeting of Experts on Noise held its twenty-eighth session from 23 February (morning) to 25 February (afternoon) 1998 only. In the absence of the Chairman of WP.29/GRB, Mr. V. Manea (Italy) was elected to chair the twenty-eighth session. Experts from the following countries participated in the work: Czech Republic; France; Germany; Hungary; Italy; Netherlands; Poland; Russian Federation; Slovakia; Spain; Sweden; Switzerland; United Kingdom. Representatives of Japan took part in the session under paragraph 11 of the Commission's Terms of Reference. Experts from the following non-governmental organizations took part in the session: International Organization for Standardization (ISO); International Organization of Motor Vehicle Manufacturers (OICA); International Motorcycle Manufacturers Association (IMMA); European Tyre and Rim Technical Organization (ETRTO).

2. The documents without a symbol distributed during the session are listed in annex 1 to this report.

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TYRE-ROAD NOISE LIMITATION

(a) Regulation No. 30 (Pneumatic tyres)

Documentation: TRANS/WP.29/GRB/R.140; TRANS/WP.29/GRB/R.144;
TRANS/WP.29/GRB/1998/1; TRANS/WP.29/GRB/1998/3; TRANS/WP.29/GRB/1998/5;
informal documents Nos. 3, 4, 6, 7 and 9 of annex 1 to this report.

3. The expert from Japan introduced document TRANS/WP.29/GRB/1998/1 and recommended to WP.29/GRB to accept the proposal regarding tyre-road noise conditions specified in ISO Draft CD 13325; he informed the Meeting of Experts of a corrigendum to document TRANS/WP.29/GRB/1998/1 (informal document No. 3, reproduced below). In support of the recommendation, he presented test results showing that the test conditions needed to be closely controlled in order to achieve the desired accuracy (informal document No. 4).

The comparison table, for the column ISO Draft CD 13325, correct in line "Temperature Correction - Reference Temperature" the words "surface 20 °C" to read "air 20 °C".

4. The expert from Germany confirmed that the task group "Test Methods" had taken the recommendation by Japan into account and that in document TRANS/WP.29/GRB/1998/5, containing addenda to TRANS/WP.29/GRB/R.140, most of the values of ISO Draft CD 13325 had been taken into account.

5. The expert from the ETRTO reiterated that, in the view of his organization, the limitation of tyre rolling noise would most appropriately be addressed by a new separate Regulation. He supported this view by enumerating the reasons for such approach (TRANS/WP.29/GRB/1998/3). He also drew the attention of WP.29/GRB to the correspondence between the proposal which had been tabled by his organization (TRANS/WP.29/GRB/R.144) and the proposal under consideration in the EC (informal document No. 7).

6. The expert from Germany presented to the Meeting of Experts a comparison of his proposal to introduce the tyre rolling noise limitation into Regulation No. 30 (TRANS/WP.29/GRB/R.140 and TRANS/WP.29/GRB/1998/5) with the proposal by the European Commission (informal document No. 7). He indicated his intention to align his proposal with that of the Commission.

7. To advance the work, WP.29/GRB accepted the approach suggested by Germany. It was agreed that, for the time being, the alignment should be restricted to the test method and the question of limits addressed at a later time, after the results of consideration in the European Community would be known. Because document TRANS/WP.29/GRB/1998/5 was not available during the session, WP.29/GRB agreed to base its considerations on a parallel proposal for Regulation No. 54 (see para. 9 below).

8. Informal document No. 6 was also considered in conjunction with Regulation No. 54 (see para. 10 below). For informal document No. 9 the consideration was based on informal document No. 10, referring to Regulation

No. 54 (see para. 11 below).

(b) Regulation No. 54 (Pneumatic tyres for commercial vehicles)

Documentation: TRANS/WP.29/GRB/R.141; TRANS/WP.29/GRB/R.144;
TRANS/WP.29/GRB/1998/1; TRANS/WP.29/GRB/1998/3; TRANS/WP.29/GRB/1998/6;
informal documents Nos. 1, 3, 4, 6, 7 and 10 of annex 1 to this report.

9. A section of document TRANS/WP.29/GRB/1998/6 related to the test method was considered in detail (Annex 9 and Annex 9 - Appendix 1). Editorial corrections to the proposed Annex 9 - Appendix 2 were also noted. Modifications to document TRANS/WP.29/GRB/1998/6 agreed by the Meeting of Experts are reproduced in annex 2 to this report. It was noted that parallel modifications should be applicable also to document TRANS/WP.29/GRB/1998/5 (see para. 7 above).

10. The expert from OICA introduced informal document No. 6. He transmitted to WP.29/GRB the opinion of his organization that the tyre-noise limitation along the proposals under consideration could not effectively reduce the overall vehicle noise. He entered a reservation to the test method which had been proposed for tyre-road noise measurement (motor vehicle coast-by procedure) and justified this by referring to the overall vehicle noise measurement by the procedure defined in Regulation No. 51. He suggested that the influence of torque on the noise emission of tyres could conveniently be addressed by measuring the tyre-road noise using a braked trailer. He also proposed several amendments to documents TRANS/WP.29/GRB/R.140 and TRANS/WP.29/GRB/1998/5. By analogy, those agreed by WP.29/GRB are incorporated in annex 2 to this report.

11. Considering informal document No. 10, submitted by the Russian Federation, WP.29/GRB discussed in detail the proposal related to the position of the microphone(s); the adopted modification to Annex 9 - Appendix 1, para. 1.1.2. (renumbered as para. 1.1.3.) is incorporated in annex 2 to this report. To consider the remaining part of the proposals (see also informal document No. 9, para. 8 above), the secretariat was requested to distribute them with official symbols.

12. For document TRANS/WP.29/GRB/1998/7, the Meeting of Experts noted that it should be superseded by informal document No. 1. The corresponding amendment to Annex 9, paragraph 3.1.7. (of document TRANS/WP.29/GRB/R.141) is reproduced in annex 2 to this report.

13. Considering the "Certificate" proposed in document TRANS/WP.29/GRB/1998/6 (Annex 9 - Appendix 3), it was not entirely clear if it had been intended to provide the format for a test report or for a supplementary "Communication" related to tyre-road noise approval. The expert from the United Kingdom suggested that for items 5.1.2. and 5.1.3. the maximum, minimum and mean temperatures should be given, and argued that for item 5.1.7. the wind direction was of importance. He also requested that

item 5.1.8. should read "Ambient noise level (dB(A))" and proposed to introduce a new item "5.3.1. Regression line slope".

14. The expert from the ETRTO reiterated the opinion of his organization that the tyre-road noise would best be addressed by a separate new Regulation (see para. 5 above). Referring to informal document No. 7, he requested that approval of a tyre range with respect to rolling noise emission should be marked by a special approval mark. He justified this by pointing out the existing large stock of tyres in the distribution network. The expert from Sweden proposed that similar to the EC proposal (informal document No. 7) the differentiation of approval marks might be achieved by a suffix "s" attached to an approval mark of a tyre which had been approved to Regulation No. 54 (or No. 30) and also belonged to a range of tyres approved with respect to their rolling noise emission.

15. The expert from Germany agreed to consider the questions of the "Certificate" and of the approval marking (see paras. 13 and 14 above) and indicated his willingness to prepare appropriate proposals for consideration at the next session.

AMENDMENTS TO REGULATION No. 51 (Noise of M and N categories of vehicles)

Documentation: TRANS/WP.29/GRB/1998/2; informal documents Nos. 2, 2/Rev, 5 and 12 of annex 1 to this report.

16. Document TRANS/WP.29/GRB/1998/2 was considered and adopted by WP.29/GRB with modifications which were based also on informal documents Nos. 2/Rev, and 12. All the adopted amendments updating the testing procedure of Regulation No. 51 in line with ISO/DIS 362 are reproduced in annex 3 to this report. It was agreed to transmit the amended document to WP.29 and to the Administrative Committee AC.1 for consideration at its ninth session (June 1998), as a proposal for draft Supplement 2 to the 02 series of amendments to Regulation No. 51.

17. Informal document No. 5 was presented by the expert from Japan. He informed WP.29/GRB that the findings in this document complemented results of the investigation of actual driving conditions of vehicles with mechanical and automatic transmissions (TRANS/WP.29/GRB/25, para. 31). In the following discussion, the expert from ISO confirmed that results of the research in Japan provided a valuable contribution for the work of ISO on developing a new urban driving noise test.

18. The expert from Germany gave a presentation of research conducted with a view to defining a test method which would guarantee a reduction of noise annoyance in actual operating conditions of urban driving. A paper based on the presentation should be distributed for information and consideration at the next session of WP.29/GRB.

RESULTS OF THE 1997 REGIONAL CONFERENCE ON TRANSPORT AND THE ENVIRONMENT

Documentation: Informal document No. 11 of annex 1 to this report.

19. The secretariat reported on the results of the Conference, which had been attended by representatives of 40 countries, including forty-five Ministers or Secretaries of State responsible for Transport or the Environment (informal document No. 11). Besides a Declaration, a Programme of Joint Action (and a Protocol on Combined Transport on Inland Waterways), an Agreement on Periodical Technical Inspections of Wheeled Vehicles (ECE/RCTE/CONF./4) had been signed by 22 countries (mostly subject to ratification). Its draft addendum 1 had been endorsed (ECE/RCTE/CONF./5/FINAL), which should regulate the periodical inspections of commercial and large passenger vehicles used in international transport. Such periodical technical inspections should in the future be required by the amendments (ECE/RCTE/CONF./6 and Corr.1) proposed to the 1971 European Agreement supplementing the 1968 Convention on Road Traffic. The secretariat confirmed that, by decision of the Inland Transport Committee at its sixtieth session, the new Agreement should, after its entry into force, be administered by WP.29. The Meeting of Experts was also informed that editorial corrections of the French text of the amendments to the 1971 European Agreement had been completed and the proposal should shortly be transmitted by the Government of Austria to the Secretary-General of the United Nations for legal processing prescribed by the Agreement.

DEFINITION OF TESTING PROVISIONS IN NOISE REGULATIONS

Documentation: Informal document No. 8 of annex 1 to this report.

20. The expert from the Czech Republic presented the synopsis of international and national testing provisions, comparing the methods and specifications defined in ECE Regulation No. 51, EC Directive 92/97/EEC, ISO draft Standard (ISO/DIS 362) and the noise test procedure for motor vehicles in Japan. In principle it was agreed that alignment was desirable in those items which influence significantly the measurement results. It was noted that the proposal for amending Regulation No. 51 was a step in the right direction (see para. 16 above). The expert from ISO informed WP.29/GRB that the Technical Committee ISO/TC43 had considered the standardization of acoustical instruments and suggested that the Meeting of Experts could help in setting policy in this area.

EXCHANGE OF INFORMATION ON NATIONAL AND INTERNATIONAL
REQUIREMENTS ON NOISE LEVELS

21. No information was provided.

OTHER BUSINESS

(a) Amendments to Regulations Nos. 9, 63 and 92

Documentation: TRANS/WP.29/1998/9; TRANS/WP.29/1998/12; TRANS/WP.29/1998/13.

22. The proposals for draft 06 series of amendments to Regulation No. 9 (TRANS/WP.29/1998/9), draft 01 series of amendments to Regulation No. 63 (TRANS/WP.29/1998/12), and draft Supplement 1 to Regulation No. 92 (TRANS/WP.29/1998/13), which had resulted from the previous session of WP.29/GRB, were examined and a number of amendments agreed, improving the alignment with EC Directive 97/24/EC. The secretariat was requested to submit the agreed additional amendments to WP.29 and to the Administrative Committee AC.1 for consideration at its eighth session (March 1998).

Note by the secretariat: The additional amendments adopted by WP.29/GRB were presented to WP.29 and AC.1 as informal documents Nos. 1, 2, and 3 and are reproduced in the report of the Working Party on its one-hundred-and-fourteenth session (for Regulation No. 9 see TRANS/WP.29/609, annex 2; for Regulation No. 63 see TRANS/WP.29/609, annex 5; for Regulation No. 92 see TRANS/WP.29/609, para. 84). The amended proposals were adopted by AC.1 at its eighth session (TRANS/WP.29/609, paras. 108, 125 and 133).

(b) Proposal for a draft global agreement

23. The Meeting of Experts was briefed by the secretariat on the development of the above-mentioned proposal (TRANS/WP.29/599, paras. 27-37). It was mentioned that the work continued to eliminate remaining divergencies and that further information was expected after the one-hundred-and-fifteenth session of WP.29. Note by the secretariat: During that session the drafting group comprised of representatives of the European Community, Japan and the United States of America agreed a final text of the proposal, which is currently being distributed to all interested parties under document symbol TRANS/WP.29/1997/1/Rev.2, with a comment period until and including 30 June 1998. Consideration of this proposal is scheduled for the one-hundred-and-fifteenth session of WP.29 (23-26 June 1998).

(c) Traffic noise modelling

24. The expert from ISO informed WP.29/GRB that development of the computer model of community noise continued and that its improved version should take into account e.g. road surface absorption, to provide better prediction of community noise levels. He invited the delegates to contact the University of Central Florida and provide comments as appropriate (TRANS/WP.29/GRB/24, para. 39).

(d) Proposal for a draft amendment to Regulation No. 59
(Replacement silencing systems)

25. The expert from Poland submitted to the secretariat a proposal for

incorporating into paragraph 1. of the Regulation a reference to Regulation No. 103. The proposal will be distributed with an official symbol for consideration at the next session of WP.29/GRB.

AGENDA FOR THE NEXT SESSION

26. The following agenda was agreed for the twenty-ninth session (Geneva, 24 and 25 September 1998) 1/:

1. Tyre-road noise 2/
 - 1.1. Amendments to Regulation No. 30 (Pneumatic tyres)
 - 1.2. Amendments to Regulation No. 54 (Pneumatic tyres for commercial vehicles)
2. Amendments to Regulation No. 51 (Noise of M and N categories of vehicles)
3. Amendment to Regulation No. 59 (Replacement silencing systems)
4. Definition of testing provisions in noise Regulations
5. Exchange of information on national and international requirements on noise levels 3/
6. Other business
 - 6.1. Proposal for a draft Global Agreement
 - 6.2. Traffic noise modelling

1/ As part of the secretariat's efforts to reduce expenditure, all the official documents distributed prior to the session by mail will not be available in the conference room for distribution to session participants. Delegates are kindly requested to bring their copies of documents to the meeting.

2/ The session will follow the forty-fourth session of the Meeting of Experts on Brakes and Running Gear (21-23 September 1998) in order to facilitate the participation of the experts from the tyre industry in the consideration of this agenda item.

3/ Delegations are invited to submit brief statements on the latest status in national requirements (if applicable) and, if necessary, to supplement this information orally.

Annex 1

LIST OF INFORMAL DOCUMENTS DISTRIBUTED WITHOUT A SYMBOL DURING THE SESSION

No.	Transmitted by	Agenda item	Language	Title
1.	ETRTO	1.2.	E	Proposal for draft amendments to Regulation No. 54 with respect to the proposal to introduce rolling noise limits (document TRANS/WP.29/GRB/R.141)
2.	ISO	2.	E	Proposal for draft amendments to Regulation No. 51; Modification to document TRANS/WP.29/GRB/1998/2
2/Rev	ISO	2.	E	Ditto above (3.1.3. Interpretation of results)
3.	Japan	1.1.and 1.2.	E	Proposal for correction on TRANS/WP.29/GRB/1998/1
4.	Japan	1.1.and 1.2.	E	Study report on test conditions for tyre/road noise
5.	Japan	2.	E	Study on Pass-by Noise Testing Methods Incorporating Urban Driving Conditions
6.	OICA	1.1.and 1.2.	E	OICA comments on tyre-road noise limitation
7.	Secretariat	1.1.and 1.2.	E	Commission Proposal for a European Parliament and Council Directive amending Council Directive 92/23/EEC relating to tyres for motor vehicles and their trailers and to their fitting (98/C 30/04) COM(97) 680 final - 977/0348(COD)
8.	Czech Republic	4.	E	Synopsis of international and national testing provisions
9.	Russian Federation	1.1.	E	Proposal for draft amendments to regulation No. 30 - The offers to the information document No. 7 (27th GRB, 4-5 September 1997)
10.	Russian Federation	1.2.	E	Proposal for draft amendments to regulation No. 54 - The offers to the

<u>No.</u>	<u>Transmitted by</u>	<u>Agenda item</u>	<u>Language</u>	<u>Title</u>
11.	Secretariat	3.	E	Conference on Transport and the Environment (Vienna, 12-14 Nov. 1997) Outcome and the follow-up
12.	ISO	2.	E	Regulation No. 51, annex 3, para. 2.2.2.
-	Germany	1.1.and 1.2.	E	Main differences between the proposals of GRB/Germany and EC-COM concerning tyre-road noise

Annex 2

ADDITIONAL AMENDMENTS

TO THE PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 54
(doc. TRANS/WP.29/GRB/1998/6, presenting addenda to TRANS/WP.29/GRB/R.141)

Annex 9,

Insert a new paragraph 1.2., to read:

"1.2. For the purpose of this annex the following classification shall apply:

- Class C2 tyres - commercial vehicle tyres with a load capacity index in single formation ≤ 121 and a speed category symbol $\geq N$;
- Class C3 tyres - commercial vehicle tyres with a load capacity index in single formation ≤ 121 and a speed category symbol $\leq M$, or commercial vehicle tyres with a load capacity index in single formation ≥ 122 ."

Paragraph 1.2. (former), renumber as paragraph 1.3.

Paragraph 1.3. (former), renumber as paragraph 1.4. and amend the words "different tyre dimensions" to read "different tyre sizes".

Paragraph 2.1., amend to read:

"2.1. Class C2 tyres, with reference to the category of use:
....."

Paragraph 2.2., amend to read:

"2.2. Class C3 tyres, with reference to the category of use:
....."

Paragraph 3.1.7. (new), amend to read:

"3.1.7. The markings "MPT", "ML" or "ET" in the case of a special-use tyre to which the corresponding sound level limit value of annex 9, paragraph 2.1. or 2.2. shall be applied."

Annex 9 - Appendix 1,

Paragraphs 1.1. and 1.1.1., replace by the following text (based on document TRANS/WP.29/GRB/1998/2):

"1.1. Acoustic measurements

The sound level meter or the equivalent measuring system, including the windscreen recommended by the manufacturer shall at least meet the requirements of Type 1 instruments in accordance with IEC 651, second edition.

The measurements shall be made using the frequency weighting A, and the time weighting F.

When using a system that includes a periodic monitoring of the A-weighted sound level, a reading should be made at a time interval not greater than 30 ms.

1.1.1. Calibration

At the beginning and at the end of every measurement session the entire measurement system shall be checked by means of a sound calibrator that fulfils the requirements for sound calibrators of at least precision Class 1 according to IEC 942:1988. Without any further adjustment the difference between the readings of two consecutive checks shall be less than or equal to 0.5 dB. If this value is exceeded the results of the measurements obtained after the previous satisfactory check shall be discarded.

1.1.2. Compliance with requirements

The compliance of the sound calibration device with the requirements of IEC 942:1988 shall be verified once a year and the compliance of the instrumentation system with the requirements of IEC 651, second edition shall be verified at least every two years, by a laboratory which is authorized to perform calibrations traceable to the appropriate standards."

Paragraph 1.1.2. (former), renumber as paragraph 1.1.3., and amend to read:

"1.1.2. Positioning of the microphone

The microphone (or microphones) must be located at a distance of 7.5 ± 0.2 m from the reference line CC' (see figure 1)"

Paragraph 1.3.1, amend to read:

"1.3.1. Air temperature

The temperature sensor must be capable of measuring the ambient temperature to within ± 1 °C and it shall be positioned in an unobstructed location The sensor should be positioned at a height of 1.2 ± 0.1 m above the test surface level,"

Paragraph 1.3.2., amend to read:

"1.3.2. Test surface temperature

The temperature sensor must be capable of measuring the test surface temperature to within ± 1 °C and it shall be positioned in a location where the temperature is representative of"

Paragraph 2.2., amend to read:

".....

The measurements shall not be made if either the ambient or test track surface temperature is below 5 °C or above [50 °C]."

Paragraphs 2.4.3. to 2.5.4., amend to read:

"2.4. Test vehicle requirements

- 2.4.1. The test vehicle shall be a motor vehicle and be fitted with four single tyres on just two axles. It shall be loaded such as to comply with the test tyre loads as specified in paragraph 2.5.2.
- 2.4.2. The wheelbase between the two axles fitted with the test tyres shall for Class C2 and C3 tyres be less than 5 metres.
- 2.4.3. Measures to minimize vehicle influence on sound level measurements

To ensure that tyre sound is not significantly affected by the test vehicle design the following requirements and recommendations are given.

Requirements:

- (a) Spray suppression flaps or other extra device to suppress spray shall not be fitted.
- (b) Addition or retention of elements in the immediate vicinity of the rims and tyres, which may screen the emitted sound, is not permitted.
- (c) Wheel alignment (toe in, camber and caster) shall be in full accordance with the vehicle manufacturer's recommendations.
- (d) Additional sound absorbing material may not be mounted in the

wheel housings or under the underbody.

- (e) Suspension shall be in such a good condition that they do not result in an abnormal reduction in ground clearance when the vehicle is loaded in accordance with the testing requirement. If available, body level regulation systems shall be adjusted to give a ground clearance during testing which is normal for unladen condition.

Recommendations to avoid parasitic sound:

- (a) Removal or modification of components on the vehicle that may contribute to the background sound of the vehicle is recommended. Any removals or modifications shall be recorded in the test report.
- (b) During testing it should be ascertained that brakes are not poorly released, causing brake noise.
- (c) It should be ascertained that electric cooling fans are not operating.
- (d) Windows and sliding roof of the vehicle shall be closed during testing.

2.5. Tyres

- 2.5.1. Four tyres of the same type and range shall be fitted on the test vehicle. Tyres with special fitting requirements shall be tested in accordance with these requirements (e.g. rotation direction). The tyres shall have full tread depth prior to run-in.

Tyres are to be tested on rims permitted by the tyre manufacturer.

2.5.2. Tyre loads

For Class C2 tyres the test load Q_t for each tyre on the test vehicle shall be [50 % to 90 % of the reference load Q_r , but the average load of all tyres shall be 70 % \pm 10 % 1/ of the reference load.]

For Class C3 tyres the test load Q_t for each tyre on the test vehicle shall be 70 % to 90 % of the reference load Q_r .

For all tyres the reference load Q_r corresponds to the maximum mass associated with the load capacity index of the tyre (see Annex 4). In case where the load capacity index is constituted by two numbers (see

1/ 70 % \pm 5 % proposed by Japan

paragraph 2.29), reference should be made to the first number.

2.5.3. Tyre inflation pressure

Each tyre fitted on the test vehicle shall have a test pressure P_t not higher than the reference pressure P_r and within the interval:

$$P_r (Q_t/Q_r)^{1.25} \leq P_t \leq 1.1 P_r (Q_t/Q_r)^{1.25}$$

where P_r is the pressure corresponding to the pressure index marked on the sidewall (see paragraph 3.1.10).

[The minimum test pressure shall be $P_t = 150$ kPa.]

2.5.4. Preparations prior to testing

The tyres should be "run-in" prior to testing to remove compound modules or other tyre pattern characteristics resulting from the moulding process. This will normally require the equivalent of about 100 km of normal use on the road.

The tyres fitted to the test vehicle shall rotate in the same direction as when they were run-in.

Prior to testing tyres shall be warmed up by running under test conditions."

Paragraphs 2.5.5. and 2.5.6., should be deleted.

Paragraph 3.2., amend the reference to "(figure 1)" to read "(figure 1 - front end of the vehicle on line AA'; rear end of the vehicle on line BB')".

Paragraph 3.3., amend to read:

"3.3. Test speed

The test vehicle speed shall be within the range:

- (i) from 70 to 90 km/h for Class C2 tyres;
- (ii) from 60 to 80 km/h for Class C3 tyres."

Paragraph 4.1., add at the end the following text:

".....
where V_{ref} is the reference speed."

Paragraph 4.2., amend to read:

".....

The reference speed V_{ref} for the determination of the final result shall be:

- (i) 80 km/h for Class C2 tyres;
- (ii) 70 km/h for Class C3 tyres.

a is the slope of the regression line"

Note: In the French version of the text of paragraph 4.2. symbol "v" should be replaced by "<" everywhere where applicable, equations including (correct is the English version of the text).

Paragraph 4.3., amend to read:

"4.3. Temperature correction

For Class C2 tyres the final result shall be normalized to a test surface reference temperature h_{ref} by applying a temperature correction, according to the following:

$$L_R(h_{ref}) = L_R(h) + K(h_{ref} - h)$$

where h = is the measured test surface temperature,
 h_{ref} = 20 °C,
 K = - 0.02 dB(A)/°C.

If the measured temperature does not change more than 5 °C within all measurements necessary for determination of the sound level of one set of tyres, the temperature correction may only be made on the final reported tyre/road sound level."

Note: In the French version of the text of paragraph 4.3. symbols < and $<_{ref}$ shall be corrected to read h and h_{ref} (three times each).

Insert new paragraphs 4.4. and 4.5., to read:

"[4.4. In order to take account of any measuring-instrument inaccuracies the results determined according to paragraph 4.3. are to be reduced by 1 dB(A).

4.5. The final result, the temperature corrected tyre/road noise level $L_R(h_{ref})$ in dB(A) shall be rounded [down] to the nearest [lower] integer value.]

Paragraph 5.(j), mark by square brackets, for re-consideration:

".....

[(j) the test result L_R : A-weighted sound level in decibel at reference speed, corrected for temperature (if applicable), expressed to one decimal place.]"

Annex 3

AMENDMENTS TO THE PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 51
ADOPTED BY THE MEETING OF EXPERTS AT ITS TWENTY-EIGHTH SESSION
(document TRANS/WP.29/GRB/1998/2)

Annex 3,

Paragraph 2.1.2.1. (new), amend to read:

"2.1.2.1. The meteorological instrumentation should be positioned adjacent to the test area at a height of 1.2 ± 0.1 m.

The measurements shall be made when the ambient air temperature is within the range from 0 °C to 40 °C.

Tests shall not be carried out if the wind speed, including gusts, at microphone height exceeds 5 m/s, during the sound measurement interval and shall be recorded during each test run.

Values representative of temperature, wind direction, relative humidity, and barometric pressure shall be recorded during the sound measurement interval."

Paragraph 2.2.2., amend to read:

"2.2.2. The tyres used for the test are selected by the vehicle manufacturer and shall comply with commercial practice; they shall correspond to one of the tyre sizes designated for the vehicle by the vehicle manufacturer and meet the minimum tread depth of 1.6 mm in the main grooves of the tread surface.

The tyres must be inflated to the pressure(s) appropriate to the test mass of the vehicle."

Paragraph 3.1.1.1., amend the words "four measurements" to read "two measurements".

Paragraphs 3.1.2.3.1. and 3.1.2.4.2.1., correct the values " \pm -2 per cent or \pm -50 rpm" to read " \pm 2 per cent or \pm 50 min⁻¹".

Paragraph 3.1.2.3.2.3., amend to read (footnotes 2/ and 3/ not modified):

"3.1.2.3.2.3. Vehicles of categories other than M₁ and N₁, in which the total number of forward gear ratios is x (including those obtained by way of an auxiliary transmission or a multi-gear axle) will be tested sequentially, using the ratio equal to or higher than x/n. 2/ 3/

Initial testing will be carried out using the ratio which is gear (x/n) or the next higher gear ratio if (x/n) is not an integer. The testing shall continue from the gear (x/n) to the next higher gear.

Shifting up gear ratios from (x/n) shall be terminating when in the gear X in which the rated engine speed is reached just before the rear of the vehicle has passed the line BB'.

Sample Calculation for Testing: There are 16 forward ratios for drive train having a transmission with 8 gears and an auxiliary transmission with 2 gears. If the engine has 230 kW then (x/n) = $(8 \times 2)/3 = 16/3 = 5 \frac{1}{3}$. The initial test gear ratio is 6th (includes the gears from both the main transmission and auxiliary which is 6th out of the 16 total gear ratios), with the next gear ratio is 7th up to ratio X.

In case of vehicles having different overall gear ratios the representative of the type by the test vehicle is determined as follows:

if the highest sound level is obtained between the ratio x/n and ratio X the vehicle shall be deemed representative of its type;

if the highest sound level is obtained at ratio x/n the vehicle selected shall be deemed representative of its type only for those vehicles which have a lower overall gear ratio at x/n;

if the highest sound level is obtained at ratio X the vehicle selected shall be deemed representative of its type only for those vehicles which have a higher overall gear ratio than the gear ratio X.

However the vehicle is deemed representative of its type also, if at the applicant's request the tests are extended over more ratios and the highest sound pressure level is obtained between the extreme ratios tested."

Paragraph 3.1.2.4.1.1., correct to read (paragraph number):

"3.1.2.4.1.1. Approach speed
....."

Paragraph 3.1.2.4.2.4., correct to read:

"3.1.2.4.2.4. Prevention of downshift
....."

Paragraph 3.1.3., amend to read:

"3.1.3. Interpretation of results

The measurement of noise emitted by the vehicle in motion shall be considered valid if the difference between the two consecutive measurements on the same side of the vehicle is not more than 2 dB(A). */

The figure recorded shall be that corresponding to the highest sound level. Should that figure exceed by more than 1 dB(A) the maximum sound level authorized for the category of vehicle tested, a second series of two measurements at the corresponding microphone position shall be made. Three out of the four results so obtained in this second position must fall within the prescribed limits.

To allow for lack of precision in the measuring instrument the figures read from it during measurement shall each be reduced by 1 dB(a).

*/ The spread of results between runs may be reduced if there is a 1 min. wait between runs, at idle in neutral, which stabilizes the vehicle operating temperature."

Annex 8, paragraph 4.3., correct to read:

".... See the ISO 10844:1994 for description of the procedure."
