Report from the Expert Group on laboratory alignment for the measurement of tyre rolling resistance installed under Regulation (EC) No 1222/2009 and listed on the Commission registry of Expert Groups to the European Commission - 2021

Inter-laboratory Alignment Procedure for Rolling Resistance Measurement in accordance with Annex V to Regulation (EU) 2020/740 of the European Parliament and of the Council of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009.

Content

1. Executive Summary

Tyres, mainly because of their rolling resistance, account for 20 % to 30 % of the fuel consumption of vehicles. A reduction of the rolling resistance of tyres may therefore contribute significantly to the energy efficiency of road transport and thus to the reduction of emissions. Fuel-efficient tyres are cost-effective since fuel savings more than compensate for the increased purchase price of tyres stemming from higher production costs.

The Regulation (EC) No 661/2009 of the European Parliament and of the Council of 13 July 2009 concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor sets out minimum requirements for the rolling resistance of tyres.

Technological developments make it possible to significantly decrease energy losses due to tyre rolling resistance beyond those minimum requirements. To reduce the environmental impact of road transport, it is therefore appropriate to lay down provisions to encourage end-users to purchase more fuel-efficient tyres by providing harmonised information on that parameter.

The Regulation[1] (EC) No 1222/2009 of the European Parliament and of the Council as amended by Commission Regulation[2] (EU) No 228/2011 and by Commission Regulation[3] (EU) No 1235/2011 establishes a framework for the provision of harmonised information on tyre parameters through labelling, allowing end-users to make an informed choice when purchasing tyres. The information to be provided under Articles 4, 5 and 6 of the Regulation (EC) No 1222/2009 on the fuel efficiency class, the external rolling noise class, and the wet grip class of tyres shall be obtained by applying the harmonised testing methods referred to in Annex I of the Regulation (EC) No 1222/2009. The fuel efficiency class must be determined on the basis of the rolling resistance coefficient (RRC) according to the specified 'A' to 'G' scale and measured in accordance with UNECE Regulation No 117 and its subsequent amendments.

As described in the Annex IVa to the Regulation (EC) No 1222/2009, the procedure for inter-laboratory comparison for rolling resistance (RR) should be based upon the generation of assigned RRC values. For the definition of these "**assigned values"**, the establishment of reference laboratories is essential.

A Network of Laboratories (including an Expert Group) was created under Regulation (EC) No 1222/2009, composed of volunteer test laboratories (Technical Services, Tyre Manufacturers) to perform inter-laboratory comparison tests on different samples of tyres, in order to establish reference data for rolling resistance measurements. The alignment method for laboratories has to measure tyre rolling resistance at the worldwide level.

The 'Expert Group on laboratory alignment for the measurement of tyre rolling resistance' has been set up on 3/9/2010. Main activities of the group are dedicated to the creation of an alignment method for laboratories having to measure tyre rolling resistance in accordance with the Regulation (EC) 1222/2009. The group met several times in 2010/2011 for the alignment of reference laboratories for the measurement of tyre rolling resistance under the Regulation, and in 2013/2014 for the first assessment of the stability and validity of the assigned values of the initial alignment according to Annex V, point 3 of the Regulation. An Intermediate check was initiated by the expert group and performed in 2015 to further improve the alignment process. This check shown that the system of Reference Laboratories is stable with the 10 participating Labs, illustrating that the evolution of some machines can be compensated (or eliminated) by the other Labs. The main difference for the assigned values is due to the tyre evolution, not the Labs evolutions. In 2016/2017, the re-assessment of the assigned values of the reference laboratories alignment have been performed. In 2018 a new intermediate check procedure has been performed. the Global results showed a complete stability, since there are no significant changes on C1/C2 and C3 machines. Thus, it was decided that the group can continue using their current equations. In 2019, the re-assessment of the assigned values of the reference laboratories alignment have been performed. In 2020 a new Intermediate check procedure have been performed. the Global results showed a complete stability, since there are no significant changes on C1/C2 and C3 machines. Thus, it was decided that the group can continue using their current equations.

The alignment of the assigned values of the reference laboratories has been done as from Annex IVa of Regulation (EC) 1222/2009.

[1] Official Journal of the European Union, L342/46-58, 22.12.2009: REGULATION (EC) No 1222/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters

[2] Official Journal of the European Union L 62/1-16, 9.3.2011: COMMISSION REGULATION (EU) No 228/2011 of 7 March 2011 amending Regulation (EC) No 1222/2009 of the European Parliament and of the Council with regard to the wet grip testing method for C1 tyres

[3] Official Journal of the European Union L 317/17-23, 30.11.2011: COMMISSION REGULATION (EU) No 1235/2011 of 29 November 2011 amending Regulation (EC) No 1222/2009 of the European Parliament and of the Council with regard to the wet grip grading of tyres, the measurement of rolling resistance and the verification procedure

Due to the periodic review of the stability of the Network of Reference Laboratories according to the Regulation, a new round of alignment among the Reference Laboratories was done in 2021. This final report includes the new alignment equations that will be applicable as of **January 1st, 2022,** and will apply to the labelling tyres in the scope of Regulation (EU) 2020/740[4]**.**

A document giving the application rules on how to handle the process of changing alignment equations, both for Reference and Candidate Laboratories is included in Annex F.

2. Introduction

The Regulation (EC) No 1222/2009 was setting a labelling classification based upon absolute rolling resistance coefficient (RRC) values. Under Annex I to the Regulation, the rolling resistance (RR) shall be measured according to the UN-ECE Regulation R117 and its subsequent amendments.

According to the experience gained by the European tyre industry from previous Round-Robin tests for tyre rolling resistance, and to the previous rounds of the inter-laboratory alignment procedure for tyre rolling resistance measurement under Regulation (EC) No 1222/2009 performed in 2011 and 2014, the deviations in test results observed could reach up to more than 1 N/kN between laboratories.

Due to this observed dispersion between measurement machines, a machine alignment procedure is necessary to get comparative Rolling Resistance Coefficient (RRC) values and give an appropriate competitive playground for the declaration of RRC labelling values according to the Regulation (EC) 1222/2009.

2.1. Members of the Expert Group

Conveners (revolving):

IDIADA (Spain),
TÜV SÜD (Germany),
UTAC CERAM (France).

Tyre manufacturers:

Apollo Vredestein,
Bridgestone,
Continental,
Goodyear,
Michelin,
Pirelli,
ETRTO (European Association)

Independent Test Laboratories:

IDIADA (Spain),
RDW (Netherlands),
TÜV SÜD Product Service (Germany),
UTAC (France)

Observers:

NOKIAN (Tyre manufacturer),
ETRMA (European Association),
JASIC (Japan),

2.2. Approach for laboratory alignment

[4] Official Journal of the European Union, L177 of 5.6.2020: REGULATION (EU) 2020/740 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009.

The procedure is based upon the generation of assigned RRC values as described in Annex IVa to Regulation (EC) 1222/2009.

The Expert Group proposed a two-steps process for laboratory alignment:

In the first step, a Network of Laboratories for the definition of assigned values was created. According to Annex IVa of Regulation 1222/2009, the last assigned values of each alignment tyre were determined by the Network of Reference Laboratories in 2015. After two years the network has to assess the stability and validity of the assigned values.

Three members have changed their C1-C2 machines (i.e., Michelin from 1P/V V2 to 1P/V V6, Pirelli from MIQ 2075 to MIQ 2094 and JASIC from RD to RG), one member has changed its C3 machine (i.e. Continental from MI1100 to M1190). Despite these changes representing more than 20% of periodic turnover for C1-C2 participant machines; it was statistically proven that these modifications do not lead to a significant change in the assigned values.

This Network of Reference Laboratories is operating the RR test machines and equipment as listed in Annex A.

The preparation of the laboratory alignment procedure consisted in the following actions:

- Assess number of alignment tyres for each category C1/C2 and C3,
- Fix details of alignment tyres (class, dimension, load index, standard or reinforced),
- Set up logistics, shipment between laboratories,
- Recommend tyre storage conditions,
- Establish the test procedure and test conditions for inter-laboratory comparison.

Based on the assigned values the Laboratories in the Network are correlated and aligned versus this “virtual reference laboratory”.

In the second step, once the Laboratories Network has been established and the alignment vs. the assigned values has been completed, any Candidate Laboratory can be aligned with any of the Network Laboratories.

2.3.Procedure for Inter-laboratory alignment

The Network of Laboratories was created Sept 3, 2010 by the Committee on the Labelling of Tyres under Regulation (EC) 1222/2009 and has been reactivated in 2013, 2016, 2018 and 2020 in order to assess the stability and validity of the assigned values.

2.3.1.Choice of laboratories

According to the rules described in the “Guideline working document on reference laboratories as defined in Commission Regulation (EU) No 1235/2011 of 29 November 2011 amending Regulation (EC) No 1222/2009 of the European Parliament and of the Council with regard to the wet grip grading of tyres, the measurement of rolling resistance and the verification procedure”, one new member (RDW) fulfil the conditions to be added to the previous group of participants in 2015 to the Network of Laboratories. In 2019 no member has been added.

The 11 Laboratories participating to the Inter laboratory alignment process are identified as follow:

Laboratory Name	Laboratory ID
TÜV SÜD	Lab0
UTAC	LAB1
IDIADA	LAB2
Michelin	LAB3
JASIC	LAB4
Goodyear	LAB5
Continental	LAB6
Bridgestone	LAB7
Pirelli	LAB8
RDW	LAB9
Vredestein	LAB10

Description and information of the machines to be used for the inter-laboratory alignment are given in Annex A.

2.3.2. Choice of alignment tyres

Following EGLA 2019 observation, six sets of alignment tyres for C1/C2 category (A to E) and five sets of alignment tyres for C3 category (F to K) were selected by the Expert Group; selection of tyres was accomplished in such way to cover the Load Index and Rolling Resistance, coefficient and force, ranges in conformity with the requirements of Regulation ECE R117.

The tyre D was tested for the pre-test and the alignment campaign at 375kPa instead of 475kPa, as marked in the tyre.

C1/C2	Brand / Size / Design	Tyre class	LI	SS	Speed [km/h]	Test Load [N]	Infl. press. [kPa]	Rim ["]	Warm-up [min]	Targeted RRC (Label)	delta RRC	Targeted RRf (N)	Average Resulting RRC (117)	delta RRC
X	BS 195/55R16 91V XL	C1	91	V	80	4 827	250	6.00	30	5.6		25.0	5.19	
A	BS 205/55R16 91H	C1	91	H	80	4 827	210	6.50	30	6.2	0.6	28.5	5.92	0.73
B	BS 225/45R17 94V XL	C1	94	V	80	5 258	250	7.50	30	6.9	0.7	36.3	6.19	0.27
C	APO 245/40ZR18 97Y	C1	97	Y	80	5 729	250	8.50	30	7.8	0.9	44.7	7.86	1.67
D	CON 225/65R16C 112R	C2	112	R	80	9 340	375	6.50	50	8.9	1.1	82.0	8.88	1.03
E	BS 215/65R16 98H	C1	98	H	80	5 886	210	6.50	30	10.4	1.5	58.0	10.09	1.21
	Range									**4.8**		**57.0**	**4.9**	

The pre-tests results have shown that tyres H and J crossed between the expected coefficient of rolling resistance and the measured coefficient of rolling resistance (see below).

Two re-test were done on tire (initially name) H9090 and J2 at different pressure to obtain RRC closer to the Targeted RRC and avoid the crossing. However, the pre-tests were not entirely redone on these two batches as the modification of pressure do not impact the correction coefficient.

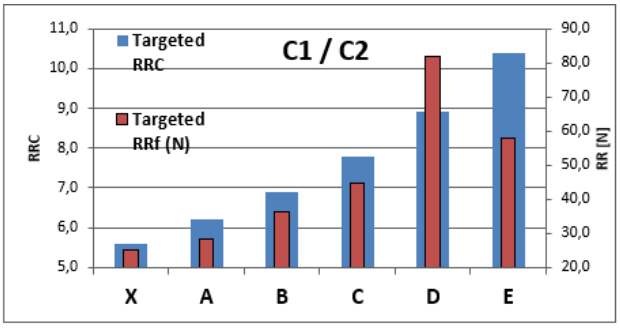
C3	Brand / Size / Design		LI	SS	Speed [km/h]	Test Load [N]	Infl. press. [kPa]	Rim ["]	Warm-up [min]	Targeted RRC (Label)	delta RRC	Targeted RRf (N)	Average Resulting RRC (117)	delta RRC	
F	GYR 385/55R22.5 160K FUELMAX T	C3	160	K	80	37 523	900	11,75	180	3,9		146	3,80		
G	MIC 245/70R17.5 X LINE ENERGY T TL 143/141J	C3	143	J	80	22 722	875	7,50	150	4,7	0,8	107	4,71	0,91	Re-test H9090 & J2
H	CON 215/75R17.5 Hybrid LS3	C3	126	M	80	14 175	900	6,00	150	5,3	0,6	75	5,75	1,04	5,41 @ 900 kPa
J	MIC 295/80R22.5 X MULTIWAY 3D XZE TL 152/148M	C3	152	M	80	29 602	700	9,00	180	5,8	0,5	172	5,60	-0,15	5,641 @ 700 kPa
K	CON 13R22.5	C3	156	K	80	33 354	875	9,00	180	7,4	1,6	247	7,02	1,42	
	Range									3,5		171,7	3,2		

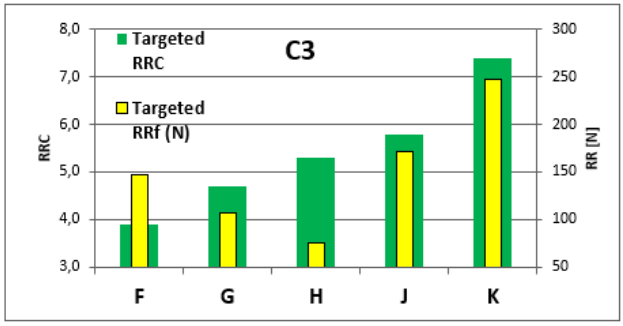
It was decided to run the alignment test with 900kPa inflation pressure for tire H instead of 700kPa applied during pre-test and 700 kPa inflation pressure for tire J instead of 850kPa applied during pre-test which successfully solved the issue.

Final selection of alignment tyres, aligned RRC and RR force:

C1/C2	Targeted RRC	Targeted RRf (N)	Brand / Size / Design	Provided by	Pretested by
X	5,6	25,0	BS 195/55R16 **91V** XL	BSEU	BSEU
A	6,2	28,5	BS 205/55R16 91H	BSEU	PIR
B	6,9	36,3	BS 225/45R17 94V XL	BSEU	GYR
C	7,8	44,7	APO 245/40ZR18 97Y	APO	RDW
D	8,9	82,0	CON 225/65R16C 112R	CON	TUEV
E	10,4	58,0	BS 215/65R16 98H	BSEU	PIR

C3	Targeted RRC	Targeted RRf (N)	Brand / Size / Design	Provided by	Pretested by
F	3,9	146,3	GYR 385/55R22.5 160K FUELMAX T	GRY	IDIADA
G	4,7	106,8	MIC 245/70R17.5 X LINE ENERGY T TL 143/141J	MIC	IDIADA
H	5,3	75,1	CON 215/75R17.5 Hybrid LS3	CON	RDW
J	5,8	171,7	MIC 295/80R22.5 X MULTIWAY 3D XZE TL 152/148M	MIC	UTAC
K	7,4	246,8	CON 13R22.5	CON	TUEV





The alignment tyres were provided by industry

Test conditions:

C1/C2	Brand / Size / Design	Tyre class	LI	SS	Speed [km/h]	Test Load [N]	Infl. press. [kPa]	Rim ["]	Warm-up [min]	Targeted RRC	delta RRC	Targeted RRf (N)
X	BS 195/55R16 **91V** XL	C1	91	V	80	4 827	250	6,00	30	5,6		25,0
A	BS 205/55R16 91H	C1	91	H	80	4 827	210	6,50	30	6,2	0,6	28,5
B	BS 225/45R17 94V XL	C1	94	V	80	5 258	250	7,50	30	6,9	0,7	36,3
C	APO 245/40ZR18 97Y	C1	97	Y	80	5 729	250	8,50	30	7,8	0,9	44,7
D	CON 225/65R16C 112R	C2	112	R	80	9 340	375	6,50	50	8,9	1,1	82,0
E	BS 215/65R16 98H	C1	98	H	80	5 886	210	6,50	30	10,4	1,5	58,0
	Range									**4,8**		**57,0**

C3	Brand / Size / Design		LI	SS	Speed [km/h]	Test Load [N]	Infl. press. [kPa]	Rim ["]	Warm-up [min]	Targeted RRC	delta RRC	Targeted RRf (N)
F	GYR 385/55R22.5 160K FUELMAX T	C3	160	K	80	37 523	900	11,75	180	3,9		146
G	MIC 245/70R17.5 X LINE ENERGY T TL 143/141J	C3	143	J	60	22 722	875	7,50	150	4,7	0,8	107
H	CON 215/75R17.5 Hybrid LS3	C3	126	M	80	14 175	900	6,00	150	5,3	0,6	75
J	MIC 295/80R22.5 X MULTIWAY 3D XZE TL 152/148M	C3	152	M	80	29 602	700	9,00	180	5,8	0,5	172
K	CON 13R22.5	C3	156	K	80	33 354	875	9,00	180	7,4	1,6	247
	Range									**3,5**		**171,7**

2.3.3. Pre-tests on each batch of tyres

As stipulated by the Expert Group, the industry provided the alignment tyres with minimum production variation. But as tyres are never strictly identical, a process of initial measurement of each tyre (4 times) was established in

order to assess the tyre category set´s individual variance; each of the laboratories providing initial measurements did tests with one whole batch of alignment tyres (same category, brand and design).

C1/C2	Provided by	Pretested by	Brand / Size
X	Bridgestone	Bridgestone	BS 195/55R16 **91V** XL
A	Bridgestone	Pirelli	BS 205/55R16 91H
B	Bridgestone	Goodyear	BS 225/45R17 94V XL
C	Vredestein	RDW	APO 245/40ZR18 97Y
D	Continental	TUEV	CON 225/65R16C 112R
E	Bridgestone	Pirelli	BS 215/65R16 98H

C3	Provided by	Pretested by	Brand / Size / Design
F	Goodyear	IDIADA	GYR 385/55R22.5 160K FUELMAX T
G	Michelin	IDIADA	MIC 245/70R17.5 X LINE ENERGY T TL 143/141J
H	Continental	RDW	CON 215/75R17.5 Hybrid LS3
J	Michelin	UTAC	MIC 295/80R22.5 X MULTIWAY 3D XZE TL 152/148M
K	Continental	TUEV	CON 13R22.5

2.3.4. Alignment tests for C1-C2 tyres

Each sample of each set of 14 C1-C2 tyres ID X, A, B, D, E and 13 C1-C2 tyres ID C has been tested 4 times on one of the 11 machines dedicated to this class of tyres

2.3.5. Alignment tests for C3 tyres

Each sample of each set of 13 C3 tyres has been tested 4 times on one of the 10 machines dedicated to this class of tyres

3. Results

The analysis of the results of the pre-tests shows that all the Rolling Resistance Machines used comply with the requirement on Sigma m of Regulation (EC) No 1222/2009.

All the results have been collected and recorded on the template report shown in Annex B.

The data formats to be used for the computations and results are included in Annex V of Regulation (EC) No 1222/2009:

- The measured RRC values corrected from drum diameter and temperature shall be rounded to 2 digits after the comma.
- Then the computations will be made with all digits: There will be no further rounding except on the final alignment equations.
- All standard deviation values will be displayed with 3 digits after comma.
- All RRC values will be displayed with 2 digits after comma.
- All alignment coefficients (A1l, B1l, A2c and B2c) will be rounded and displayed with 4 digits after comma.

Deliverables of the Network of Reference Laboratories Expert Group:

➢ For pre-tests:

- Raw data and aligned data
- Qualification of the data
- Precision and uncertainty values

- Correction factor for each batch
- Conclusions

➢ For alignment tests:

- Raw data and aligned data
- Qualification of the data
- Precision and uncertainty values
- Assigned values
- Qualification of the assigned value
- Alignment equations for reference laboratories
- Precision and uncertainty of predicted values

3.1.Pre-tests results

Each tyre of one batch has been tested on one machine four times and the average and the standard deviation of the three last measurements has been calculated.

The pre-tests batches include at least one additional tyre for each batch and the group decide to choose the alignment tyres to be use in each batch by considering the following criteria appropriate and effective:

Excludes any tyre that has got a standard deviation above the limit (5.0 %) for the three last measurements (Raw values), then in case all the tyres respect the standard deviation condition (Raw values), then remove any tyre who do not make the tyre batch distributed evenly.

The analysis, based on the three last measurements (out of four) for each tyre, results in exclusion of the following samples from the batches:

Batch X Tyres N°8, N°11& N°12
Batch A Tyre N°0, N°1 & N°13
Batch B Tyre N°2, N°3 & N°13
Batch C Tyre N°6 & N°10
Batch D Tyres N°5, N°6 & N°12
Batch E Tyres N°3, N°8 & N°10

Each remaining tyre from the batch has been re-identified as A0, A1… A10 till X0…, X9, X10.

Batch F Tyre N°6, N°9 & N°11
Batch G Tyre N°0, N°2 & N°11
Batch H Tyre N°5, N°8 & N°10
Batch J Tyres N°0, N°5 & N°8
Batch K Tyres N°10, N°11 & N°12

Each remaining tyre from the batch has been re-identified as F0, F1… F9 till K0…, K8, K9.

Then, the repeatability of the pre-tests data was analysed, these data include the variation of the RR measurement process as well as the evolution of the tyres during the pre-tests. The goal of the pre-tests was to analyse the variation within a batch of tyres and to use the results to apply a correction factor. The data and the analysis of these data are given in Annex C to this report.

Another outcome from these pre-tests was the maximum variation of the measured RR coefficient for a set of 11 carefully selected tyres:

- For C1-C2 = -3.13%, +3.42%
- For C3 = -2.65%, +0.03%

Even if we could consider that these results are not bad for manufactured products, a correction factor will be used to normalize the values for future computerization of regression function for each machine.

3.2.Alignment tests results

Each tyre has been tested on one machine four times and the correction factor of the tested tyre was applied to each measurement then the average of three corrected last measurements has been calculated. The data and the analysis of these data are given in Annex D to this report.

Based on the experience gained during the three previous inter-laboratory rounds in 2011, 2015, 2017 and in 2019, all individual data have been used for the calculation of the linear regression function for each laboratory.

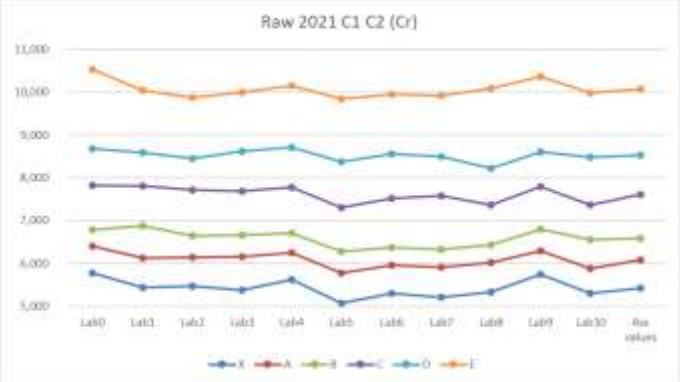
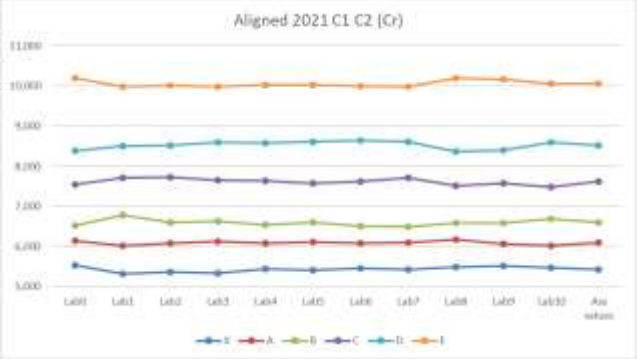
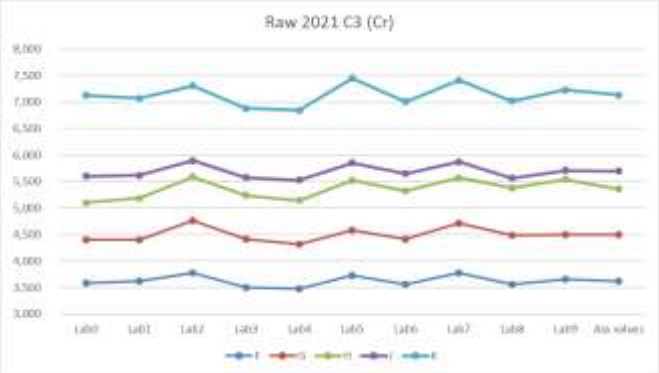
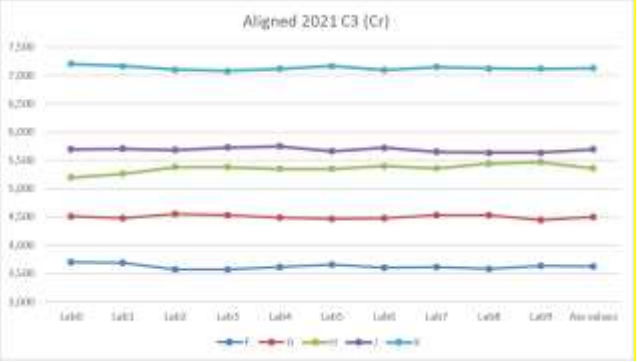
4. Conclusion

Pre-tests are still needed to monitor the dispersion of each batch of tyres and to improve the accuracy of alignment equation for each machine. Independent from the variation from one laboratory to another (if they are compliant with the requirement of Annex V of Regulation (EC) No 1222/2009 or following the Annex to the proposal for a Regulation on the labelling of tyres with respect to fuel efficiency and other essential parameters repealing Regulation (EC) N°1222/2009) the system is robust.

The experience gained confirms that a first test in the same conditions is necessary before starting the series of measurements.

The statistical analysis confirms that the correlation is very high.

The accuracy of measured values is improved by this alignment procedure:

Maximum deviation from assigned values before alignment For C1-C2 = 6.59% / -6.55% 	Maximum deviation from assigned values after alignment For C1-C2 = -2.11% / +2.80% 
Maximum deviation from assigned values before alignment For C3 = -4.82% / 5.85% 	Maximum deviation from assigned values after alignment For C3 = -2.98% / +2.07% 

Other documents are annexed to this report:

- Annex E: the template for candidate / reference laboratory alignment.
- Annex F: Proposal of guidance on how to handle the process of changing alignment equations, both for Reference and Candidate laboratories.

Annex A – Equipment information

	TUV SUD N°0		UTAC N°1		IDIADA N°2		Michelin N°3		JASIC N°4	
ADDRESS	TÜV SÜD Product Service GmbH Daimlerstrasse 15 85748 Garching/Munich, Germany		Groupe UTAC CERAM Autodrome de Linas-Montlhéry 91319 Montlhéry Cedex France		IDIADA Automotive Technology, S.A. Workshop homologation Division Pol Ind L'Albornar, AP2 exit 12 E-43710 SANTA OLIVA		CERL Michelin - Magasin F43 Compte J-B MATHIEU Zone Industrielle de Ladoux 63118 Cébazat France		Bridgestone Corporation Technology Centre 3-1-1, Ogawahigashi-cho, Kodaira-shi, Tokyo 187-8531 Japan	
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Tyre type	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3
Location	Garching - Germany		Linas-Montlhéry - France		Santa-Oliva - Spain		Ladoux - France		Tokyo - Japan	
Machine Identification #	H8	H4	BAN0226-VL	BAN0226-PL	10223	10259	1P/V V6	RRPL A1	RG	RE
Machine operational	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Machine complies to performance criteria Network Laboratories	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Measurement method	Power	Power	Torque	Torque	Torque	Torque	Deceleration	Deceleration	Force	Force
Drum diameter [m]	2.0	1.7	2.0	2.0	1.7	1.7	2.706	2.706	2	3
Drum surface	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel
Max. test load [kg]	1835	10194	2000	6000	1500	7000	2039	8155	1500	8000

	Goodyear N°5		Continental N°6		Bridgestone N°7		Pirelli N°8		RDW N°9		Vredestein N°10	
ADDRESS	Goodyear Innovation Center Luxembourg Avenue Gordon Smith L-7750 Colmar-Berg Luxembourg		Continental Reifen Deutschland GmbH Jaedekamp 30 30419 Hannover		Bridgestone Europe – Italian Branch Via del Fosso del Salceto, 13/15 – 00128 Rome, Italy		Pirelli Tyre SpA Sperimentazione Indoor via Chiese; 51 20126 Milano ITALY		RDW Testcentrum Talingweg 76 8218 NX Lelystad The Netherlands		Apollo Tyres Global R&D Strootsweg 24 Enschede 7547 RW Netherlands	
Contact person	Florian NICOLAS		Rainer HEIN		Italo FUNARO		Andrea VERGANI		Mark Stuivenvolt Dirk Visser		Ralph Greve	
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Tyre type	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3
Location	Colmar-Berg - Luxembourg		Hannover - Germany		Rome - Italy		Milan - Italy	Izmit - Turkey	Lelystad - The Netherlands		Enschede - The Netherlands	
Machine Identification #	M/C # 4	M/C # 5	M1320	M1190	T34001	HU-2	MIQ 2094	US2-45127	OPS 26 - P1	OPS 26 - P2	Testmachine 15	-
Machine operational	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	-
Machine complies to performance criteria Network Laboratories	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	-
Measurement method	Torque	Torque	Torque	Torque	Torque	Torque	Torque	Torque	Torque	Torque	Torque	-
Drum diameter [m]	2	1.7	2	2	2	1.7	2	2	2	2	2	-
Drum surface	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth Steel	Smooth steel	-
Max. test load [kg]	1250	5000	1529	8155	1275	6120	2000	6000	2000	5000	1450	-

Annex B – Data report template (for pre-test and test protocols)

TIRE ROLLING RESISTANCE TEST PROTOCOL

Test Lab

General Data

Test Lab/Location:		Report No.	
Test-Rig:		Test Date:	
Drum Ø [m]:	2.0	Drum Surface:	smooth steel
Test Conditions:	UN R117 Annex 6	Test Method:	Torque method

Test-Rim

Width x Diameter [´´]:		Material:	

Tire

Tire-ID:	/	Tire Class (C1, C2, C3):	1
DOT-Nr.:		Brand-/Trade Name:	
Tire Manufacturer:		Reinforced yes/no:	
Size:		Speed Index:	
Nominal Diameter [m]:	0.686	Load Index:	98

Set Test-Data

Setting	Warm-up [min]:	Speed [km/h]:	Load [daN]:	Camb. [°]:	p_{cold} [kPa]:	T_{amb} [°C]:
1			589.0	0	210	25.0
2			589.0	0	210	25.0
3			589.0	0	210	25.0
4			589.0	0	210	25.0

Measurements

Rec.	Speed [km/h]:	Load [daN]:	T_{amb} [°C]:
1	80.0	588.4	25.7
2	80.0	588.4	25.7
3	80.0	588.4	25.4
4	80.0	588.4	25.6

Remark:
Average ambient temperature during whole process

Results (non corrected results)

Rec.	Skim Test Load (N)	F_r [N]:	Temp_corr ?	F_{PL} [N]:	Automatic Calc. c_r [N/kN]
1	100	58.70	0	26.90	9.98
2	100	58.30	0	26.90	9.91
3	100	58.70	0	27.20	9.98
4	100	58.80	0	27.20	9.99

Corrected Results (Temperature 25°C, Drum diameter 2.0m)

Rec.	Correction Formula	Automatic Calc. F_r [N]:	F_{PL} [N]:	Automatic Calc. c_r [N/kN]
1	0.008	59.03	27.05	10.03
2		58.63	27.05	9.96
3		58.89	27.29	10.01
4		59.08	27.33	10.04

Aligned Results acc. EU 1235/2011 (Temperature 25°C, Drum diameter 2.0m)

1	Slope	0.9830			10.04
2	Intercept	0.1840			9.97
3					10.02
4					10.05

Reference Lab Test Protocol Version 1.2 20 October, 2014

Comments:

If Fr (N) in fields H31 to H34 and RRC in fields T31 to T34 are already temperature corrected, enter Temp_corr = 1 (otherwise 0

Temperature correction coefficient for C1 is 0.008, for C2 and C3 with LI<=121 it is 0.01 and for C3 with LI>121 it is 0.006.

Annex C - Pre-tests results

1. Pre-tests results & Correction Factors for C1-C2 tyres

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
X00	5.14	5.13	5.15	5.14	**1.010**	**Min**	96.94%
X01	5.23	5.24	5.20	5.22	**0.994**	**Max**	103.10%
X02	5.18	5.15	5.16	5.16	**1.006**	**Range**	6.16%
X03	5.27	5.24	5.26	5.26	**0.988**		
X04	5.25	5.22	5.25	5.24	**0.991**		
X05	5.19	5.19	5.20	5.19	**1.000**		
X06	5.26	5.26	5.27	5.26	**0.987**		
X07	5.09	5.07	5.07	5.08	**1.023**		
X08	5.17	5.15	5.16	5.16	**1.006**		
X09	5.10	5.11	5.10	5.10	**1.017**		
X10	5.04	5.04	5.03	5.04	**1.031**		
XSPARE_1	5.32	5.28	5.27	5.29	**0.982**		
XSPARE_2	5.35	5.37	5.35	5.36	**0.969**		
			Avg_total	**5.19**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
A00	5.96	5.94	5.95	5.95	**0.995**	**Min**	98.84%
A01	5.98	5.96	5.91	5.95	**0.995**	**Max**	100.86%
A02	5.95	5.91	5.91	5.92	**1.000**	**Range**	2.02%
A03	5.93	5.91	5.88	5.91	**1.002**		
A04	5.94	5.88	5.93	5.92	**1.001**		
A05	5.89	5.87	5.86	5.87	**1.008**		
A06	5.97	5.96	5.93	5.95	**0.995**		
A07	5.89	5.83	5.89	5.87	**1.009**		
A08	5.93	5.90	5.91	5.91	**1.001**		
A09	5.91	5.87	5.89	5.89	**1.005**		
A10	5.91	5.89	5.89	5.90	**1.004**		
ASPARE_1	6.00	5.90	5.91	5.94	**0.997**		
ASPARE_2	5.99	5.99	5.99	5.99	**0.988**		
			Avg_total	**5.92**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
B00	6.21	6.19	6.18	6.19	**0.999**	**Min**	99.03%
B01	6.16	6.16	6.11	6.14	**1.007**	**Max**	101.52%
B02	6.23	6.20	6.23	6.22	**0.995**	**Range**	2.49%
B03	6.23	6.15	6.15	6.18	**1.001**		
B04	6.23	6.20	6.19	6.21	**0.997**		
B05	6.19	6.13	6.16	6.16	**1.004**		
B06	6.16	6.14	6.19	6.16	**1.004**		
B07	6.22	6.19	6.23	6.21	**0.996**		
B08	6.22	6.21	6.24	6.22	**0.994**		
B09	6.23	6.18	6.21	6.21	**0.997**		
B10	6.19	6.16	6.16	6.17	**1.003**		
BSPARE_1	6.26	6.23	6.25	6.25	**0.990**		
BSPARE_2	6.09	6.10	6.09	6.09	**1.015**		
			Avg_total	**6.19**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
C00	7.91	7.91	7.84	7.89	**0.996**	**Min**	98.09%
C01	7.91	7.91	7.84	7.89	**0.996**	**Max**	101.42%
C02	7.85	7.78	7.77	7.80	**1.007**	**Range**	3.33%
C03	7.78	7.78	7.73	7.76	**1.012**		
C04	7.90	7.83	7.83	7.85	**1.000**		
C05	7.87	7.83	7.79	7.83	**1.003**		
C06	7.86	7.84	7.80	7.83	**1.003**		
C07	7.80	7.79	7.83	7.81	**1.006**		
C08	7.90	7.96	7.86	7.91	**0.994**		
C09	7.81	7.90	7.85	7.85	**1.000**		
C10	7.94	7.96	7.99	7.96	**0.987**		
CSPARE_1	7.99	8.04	8.00	8.01	**0.981**		
CSPARE_2	7.71	7.78	7.75	7.75	**1.014**		
			Avg_total	**7.86**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
D00	8.92	8.89	8.88	8.90	**0.998**	**Min**	99.10%
D01	8.95	8.89	8.90	8.91	**0.997**	**Max**	101.17%
D02	8.91	8.88	8.85	8.88	**1.000**	**Range**	2.07%
D03	8.95	8.93	8.89	8.92	**0.995**		
D04	8.89	8.90	8.87	8.89	**1.000**		
D05	8.87	8.84	8.82	8.84	**1.004**		
D06	8.90	8.85	8.83	8.86	**1.003**		
D07	8.91	8.88	8.85	8.88	**1.000**		
D08	8.91	8.92	8.85	8.89	**0.999**		
D09	8.95	8.94	9.00	8.96	**0.991**		
D10	8.97	8.92	8.94	8.94	**0.993**		
DSPARE_1	8.85	8.80	8.79	8.81	**1.008**		
DSPARE_2	8.81	8.77	8.76	8.78	**1.012**		
			Avg_total	**8.88**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
E00	10.06	10.01	10.01	10.03	**1.006**	**Min**	98.43%
E01	10.02	10.02	10.01	10.02	**1.007**	**Max**	101.20%
E02	10.26	10.08	10.12	10.15	**0.994**	**Range**	2.76%
E03	10.00	10.01	10.00	10.00	**1.009**		
E04	10.14	10.12	10.08	10.11	**0.998**		
E05	10.16	10.20	10.18	10.18	**0.991**		
E06	10.23	10.23	10.20	10.22	**0.987**		
E07	10.13	10.05	10.18	10.12	**0.997**		
E08	9.99	10.02	10.03	10.01	**1.008**		
E09	10.01	10.07	10.02	10.03	**1.006**		
E10	10.07	10.05	10.07	10.06	**1.003**		
ESPARE_1	9.97	9.98	9.96	9.97	**1.012**		
ESPARE_2	10.31	10.22	10.22	10.25	**0.984**		
			Avg_total	**10.09**			

2. Pre-tests results & Correction Factors for C3 tyres

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
F00	3.83	3.82	3.79	3.81	**0.997**	**Min**	99.41%
F01	3.79	3.78	3.79	3.79	**1.004**	**Max**	100.64%
F02	3.78	3.78	3.79	3.78	**1.005**	**Range**	1.23%
F03	3.82	3.80	3.80	3.81	**0.998**		
F04	3.80	3.77	3.76	3.78	**1.006**		
F05	3.82	3.82	3.79	3.81	**0.998**		
F06	3.82	3.81	3.80	3.81	**0.998**		
F07	3.80	3.81	3.81	3.81	**0.998**		
F08	3.80	3.81	3.79	3.80	**1.000**		
F09	3.83	3.79	3.80	3.81	**0.998**		
FSPARE_1	3.80	3.80	3.76	3.79	**1.004**		
FSPARE_2	3.84	3.81	3.82	3.82	**0.994**		
			Avg_total	**3.8**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
G00	4.71	4.68	4.74	4.71	**0.999**	**Min**	98.39%
G01	4.70	4.67	4.68	4.68	**1.005**	**Max**	101.87%
G02	4.63	4.64	4.66	4.64	**1.014**	**Range**	3.48%
G03	4.75	4.78	4.75	4.76	**0.989**		
G04	4.76	4.74	4.66	4.72	**0.997**		
G05	4.72	4.70	4.69	4.70	**1.001**		
G06	4.81	4.75	4.72	4.76	**0.989**		
G07	4.75	4.75	4.71	4.74	**0.994**		
G08	4.69	4.67	4.68	4.68	**1.006**		
G09	4.75	4.81	4.79	4.78	**0.984**		
GSPARE_1	4.67	4.62	4.74	4.68	**1.006**		
GSPARE_2	4.61	4.62	4.63	4.62	**1.019**		
			Avg_total	**4.71**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
H00	5.49	5.43	5.42	5.45	**0.994**	**Min**	99.36%
H01	5.44	5.42	5.44	5.43	**0.997**	**Max**	100.59%
H02	5.35	5.45	5.43	5.41	**1.001**	**Range**	1.23%
H03	5.45	5.43	5.43	5.44	**0.996**		
H04	5.46	5.44	5.40	5.43	**0.997**		
H05	5.42	5.38	5.35	5.38	**1.006**		
H06	5.45	5.42	5.35	5.41	**1.002**		
H07	5.40	5.38	5.42	5.40	**1.003**		
H08	5.39	5.41	5.35	5.38	**1.006**		
H09	5.44	5.44	5.36	5.41	**1.000**		
HSPARE_1	5.43	5.43	5.29	5.38	**1.006**		
HSPARE_2	5.47	5.43	5.45	5.45	**0.994**		
			Avg_total	**5.42**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
J00	5.68	5.67	5.64	5.66	**1.001**	**Min**	97.84%
J01	5.68	5.64	5.61	5.64	**1.004**	**Max**	102.32%
J02	5.68	5.67	5.63	5.66	**1.001**	**Range**	4.47%
J03	5.74	5.71	5.66	5.70	**0.994**		
J04	5.78	5.73	5.71	5.74	**0.988**		
J05	5.76	5.72	5.72	5.73	**0.989**		
J06	5.71	5.67	5.64	5.67	**0.999**		
J07	5.71	5.67	5.64	5.67	**0.999**		
J08	5.62	5.59	5.57	5.59	**1.013**		
J09	5.64	5.60	5.57	5.60	**1.012**		
JSPARE_1	5.83	5.78	5.77	5.79	**0.978**		
JSPARE_2	5.57	5.53	5.52	5.54	**1.023**		
			Avg_total	**5.67**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
K00	7.00	7.01	7.01	7.01	**1.002**	**Min**	98.37%
K01	7.00	7.01	7.00	7.00	**1.002**	**Max**	100.96%
K02	7.04	7.08	7.06	7.06	**0.994**	**Range**	2.59%
K03	6.99	6.97	6.97	6.98	**1.006**		
K04	7.03	7.00	7.01	7.01	**1.001**		
K05	7.01	6.97	6.97	6.98	**1.005**		
K06	7.02	7.00	7.01	7.01	**1.001**		
K07	7.07	7.03	7.03	7.04	**0.997**		
K08	7.04	7.03	7.01	7.03	**0.999**		
K09	7.03	7.03	7.02	7.03	**0.999**		
KSPARE_1	6.96	6.95	6.95	6.95	**1.010**		
KSPARE_2	7.16	7.12	7.13	7.14	**0.984**		
			Avg_total	**7.02**			

Annex D - Alignment tests results - Cr (N/kN)

1. Raw data

1.1. C1-C2 tyres

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected Avg	2	3	4	sigma
TÜV	X0	5,76	5,76	5,71	5,69	5,720	0,036	1,010	5,778	5,82	5,77	5,75	0,036
UTAC	X1	5,58	5,46	5,45	5,48	5,466	0,017	0,994	5,434	5,43	5,42	5,45	0,017
Idiada	X2	5,54	5,43	5,44	5,45	5,440	0,010	1,006	5,471	5,46	5,47	5,48	0,010
Mi	X3	5,52	5,43	5,43	5,46	5,440	0,017	0,988	5,374	5,36	5,36	5,39	0,017
JASIC	X4	5,69	5,67	5,69	5,64	5,667	0,025	0,991	5,615	5,62	5,64	5,59	0,025
GY	X5	5,11	5,07	5,09	5,04	5,067	0,025	1,000	5,066	5,07	5,09	5,04	0,025
Conti	X6	5,40	5,40	5,35	5,38	5,377	0,025	0,987	5,304	5,33	5,28	5,31	0,025
BS	X7	5,11	5,11	5,10	5,09	5,100	0,010	1,023	5,216	5,23	5,22	5,21	0,010
Pi	X8	5,35	5,32	5,26	5,31	5,297	0,032	1,006	5,330	5,35	5,29	5,34	0,032
RDW	X9	5,55	5,64	5,64	5,65	5,643	0,006	1,017	5,742	5,74	5,74	5,75	0,006
Vred	X10	5,15	5,14	5,16	5,13	5,143	0,015	1,031	5,303	5,30	5,32	5,29	0,016
									5,421				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected Avg	2	3	4	sigma
TÜV	A0	6,54	6,44	6,44	6,40	6,427	0,023	0,995	6,395	6,408	6,408	6,368	0,023
UTAC	A1	6,35	6,17	6,14	6,16	6,155	0,015	0,995	6,125	6,136	6,108	6,131	0,015
Idiada	A2	6,21	6,10	6,18	6,16	6,147	0,042	1,000	6,147	6,100	6,180	6,160	0,042
Mi	A3	6,18	6,14	6,16	6,15	6,150	0,010	1,002	6,164	6,154	6,174	6,164	0,010
JASIC	A4	6,31	6,27	6,21	6,26	6,247	0,032	1,001	6,251	6,274	6,214	6,264	0,032
GY	A5	5,79	5,77	5,71	5,72	5,733	0,032	1,008	5,779	5,816	5,756	5,766	0,032
Conti	A6	6,01	6,00	5,99	5,97	5,987	0,015	0,994	5,954	5,967	5,957	5,937	0,015
BS	A7	5,91	5,88	5,86	5,84	5,860	0,020	1,009	5,910	5,931	5,910	5,890	0,020
Pi	A8	6,01	6,03	5,98	6,02	6,010	0,026	1,001	6,017	6,037	5,987	6,027	0,026
RDW	A9	6,23	6,29	6,23	6,26	6,260	0,030	1,005	6,292	6,323	6,262	6,292	0,030
Vred	A10	5,89	5,85	5,86	5,85	5,853	0,006	1,004	5,877	5,874	5,884	5,874	0,006
									6,083				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	B0	6,81	6,81	6,81	6,77	6,797	0,023	0,999	6,789	6,80	6,80	6,76	0,023
UTAC	B1	6,96	6,82	6,85	6,83	6,832	0,017	1,007	6,879	6,86	6,90	6,88	0,018
Idiada	B2	6,81	6,71	6,66	6,67	6,680	0,026	0,995	6,643	6,67	6,62	6,63	0,026
Mi	B3	6,65	6,65	6,63	6,68	6,653	0,025	1,001	6,663	6,66	6,64	6,69	0,025
JASIC	B4	6,77	6,78	6,72	6,68	6,727	0,050	0,997	6,704	6,76	6,70	6,66	0,050
GY	B5	6,37	6,27	6,26	6,25	6,260	0,010	1,004	6,286	6,30	6,29	6,28	0,010
Conti	B6	6,47	6,45	6,44	6,43	6,440	0,010	0,990	6,377	6,39	6,38	6,37	0,010
BS	B7	6,41	6,37	6,36	6,35	6,360	0,010	0,996	6,332	6,34	6,33	6,32	0,010
Pi	B8	6,53	6,50	6,42	6,49	6,470	0,044	0,994	6,431	6,46	6,38	6,45	0,043
RDW	B9	6,98	6,85	6,84	6,79	6,827	0,032	0,997	6,804	6,83	6,82	6,77	0,032
Vred	B10	6,60	6,54	6,53	6,54	6,537	0,006	1,003	6,554	6,56	6,55	6,56	0,006
									6,588				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	C0	8,01	7,84	7,89	7,84	7,857	0,029	0,996	7,827	7,81	7,86	7,81	0,029
UTAC	C1	7,98	7,86	7,80	7,84	7,830	0,030	0,996	7,800	7,83	7,77	7,81	0,030
Idiada	C2	7,76	7,68	7,66	7,64	7,660	0,020	1,007	7,716	7,74	7,72	7,70	0,020
Mi	C3	7,64	7,58	7,61	7,58	7,590	0,017	1,012	7,682	7,67	7,70	7,67	0,018
JASIC	C4	7,81	7,78	7,78	7,77	7,777	0,006	1,000	7,780	7,78	7,78	7,77	0,006
GY	C5	7,32	7,32	7,25	7,25	7,273	0,040	1,003	7,298	7,35	7,27	7,27	0,041
Conti	C6	7,54	7,50	7,52	7,47	7,497	0,025	1,003	7,519	7,52	7,54	7,49	0,025
BS	C7	7,58	7,55	7,53	7,51	7,530	0,020	1,006	7,578	7,60	7,58	7,56	0,020
Pi	C8	7,40	7,39	7,43	7,44	7,420	0,026	0,993	7,370	7,34	7,38	7,39	0,026
RDW	C9	7,92	7,78	7,76	7,82	7,787	0,031	1,000	7,790	7,78	7,76	7,82	0,031
Vred	C10	7,51	7,50	7,46	7,45	7,470	0,026	0,987	7,370	7,40	7,36	7,35	0,026
									7,612				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	D0	8,76	8,68	8,69	8,70	8,690	0,010	0,998	8,676	8,67	8,68	8,69	0,010
UTAC	D1	8,72	8,64	8,62	8,59	8,616	0,025	0,997	8,587	8,61	8,59	8,56	0,025
Idiada	D2	8,53	8,47	8,46	8,43	8,453	0,021	1,000	8,456	8,47	8,46	8,43	0,021
Mi	D3	8,72	8,67	8,65	8,65	8,657	0,012	0,995	8,617	8,63	8,61	8,61	0,011
JASIC	D4	8,70	8,71	8,73	8,69	8,710	0,020	1,000	8,706	8,71	8,73	8,69	0,020
GY	D5	8,48	8,36	8,34	8,31	8,337	0,025	1,004	8,374	8,40	8,38	8,35	0,025
Conti	D6	8,64	8,55	8,53	8,52	8,533	0,015	1,003	8,555	8,57	8,55	8,54	0,015
BS	D7	8,54	8,51	8,49	8,49	8,497	0,012	1,000	8,499	8,51	8,49	8,49	0,012
Pi	D8	8,34	8,29	8,20	8,22	8,237	0,047	0,999	8,227	8,28	8,19	8,21	0,047
RDW	D9	8,79	8,70	8,64	8,70	8,680	0,035	0,991	8,602	8,62	8,56	8,62	0,034
Vred	D10	8,63	8,59	8,54	8,50	8,543	0,045	0,993	8,486	8,53	8,48	8,44	0,045
									8,526				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	E0	10,58	10,44	10,48	10,48	10,467	0,023	1,006	10,532	10,51	10,55	10,55	0,023
UTAC	E1	10,08	10,00	9,95	9,94	9,964	0,031	1,007	10,037	10,07	10,03	10,01	0,032
Idiada	E2	9,91	9,95	9,92	9,95	9,940	0,017	0,994	9,877	9,89	9,86	9,89	0,017
Mi	E3	9,89	9,86	9,91	9,94	9,903	0,040	1,009	9,989	9,94	10,00	10,03	0,041
JASIC	E4	10,19	10,13	10,19	10,17	10,163	0,031	0,998	10,139	10,11	10,17	10,15	0,030
GY	E5	10,01	9,97	9,91	9,90	9,927	0,038	0,991	9,838	9,88	9,82	9,81	0,038
Conti	E6	10,13	10,11	10,07	10,06	10,080	0,026	0,987	9,951	9,98	9,94	9,93	0,026
BS	E7	9,91	9,93	9,96	9,93	9,940	0,017	0,997	9,910	9,90	9,93	9,90	0,017
Pi	E8	10,03	9,96	10,01	10,04	10,003	0,040	1,008	10,079	10,04	10,09	10,12	0,041
RDW	E9	10,32	10,30	10,35	10,27	10,307	0,040	1,006	10,364	10,36	10,41	10,33	0,041
Vred	E10	10,01	9,97	9,94	9,94	9,950	0,017	1,003	9,976	10,00	9,97	9,97	0,017
									10,063				

1.2. C3 tyres

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	F0	3,59	3,59	3,60	3,60	3,597	0,006	0,997	3,585	3,58	3,59	3,59	0,006
UTAC	F1	3,65	3,59	3,61	3,62	3,606	0,012	1,004	3,620	3,61	3,62	3,63	0,012
Idiada	F2	3,80	3,78	3,75	3,76	3,763	0,015	1,005	3,781	3,80	3,77	3,78	0,015
Mi	F3	3,53	3,52	3,50	3,49	3,503	0,015	0,998	3,498	3,51	3,49	3,48	0,015
JASIC	F4	3,48	3,46	3,45	3,45	3,453	0,006	1,006	3,475	3,48	3,47	3,47	0,006
GY	F5	3,75	3,75	3,74	3,72	3,737	0,015	0,998	3,728	3,74	3,73	3,71	0,015
Conti	F6	3,60	3,57	3,56	3,56	3,563	0,006	0,998	3,555	3,56	3,55	3,55	0,006
BS	F7	3,81	3,78	3,79	3,77	3,780	0,010	0,998	3,774	3,77	3,78	3,76	0,010
Pi	F8	3,57	3,55	3,56	3,55	3,553	0,006	1,000	3,554	3,55	3,56	3,55	0,006
RDW	F9	3,70	3,68	3,66	3,66	3,667	0,012	0,998	3,661	3,67	3,65	3,65	0,012
									3,623				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	G0	4,39	4,40	4,41	4,42	4,410	0,010	0,999	4,407	4,40	4,41	4,42	0,010
UTAC	G1	4,41	4,40	4,37	4,36	4,379	0,019	1,005	4,400	4,42	4,40	4,38	0,019
Idiada	G2	4,80	4,70	4,70	4,70	4,700	0,000	1,014	4,764	4,76	4,76	4,76	0,000
Mi	G3	4,52	4,49	4,47	4,44	4,467	0,025	0,989	4,416	4,44	4,42	4,39	0,025
JASIC	G4	4,39	4,33	4,33	4,33	4,330	0,000	0,997	4,318	4,32	4,32	4,32	0,000
GY	G5	4,64	4,60	4,58	4,57	4,583	0,015	1,001	4,586	4,60	4,58	4,57	0,015
Conti[2]	G6	4,51	4,48	4,46	4,45	4,463	0,015	0,989	4,413	4,43	4,41	4,40	0,015
BS	G7	4,78	4,74	4,80	4,70	4,747	0,050	0,994	4,716	4,71	4,77	4,67	0,050
Pi	G8	4,49	4,50	4,47	4,42	4,463	0,040	1,006	4,489	4,53	4,50	4,44	0,041
RDW	G9	4,59	4,58	4,57	4,56	4,570	0,010	0,984	4,496	4,51	4,50	4,49	0,010
									4,501				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	H0	5,20	5,16	5,13	5,10	5,130	0,030	0,994	5,100	5,13	5,10	5,07	0,030
UTAC	H1	5,22	5,21	5,21	5,17	5,200	0,022	0,997	5,182	5,19	5,20	5,16	0,022
Idiada	H2	5,53	5,63	5,57	5,55	5,583	0,042	1,001	5,588	5,64	5,58	5,56	0,042
Mi	H3	5,29	5,25	5,30	5,23	5,260	0,036	0,996	5,239	5,23	5,28	5,21	0,036
JASIC	H4	5,23	5,17	5,14	5,17	5,160	0,017	0,997	5,143	5,15	5,12	5,15	0,017
GY	H5	5,50	5,50	5,50	5,46	5,487	0,023	1,006	5,519	5,53	5,53	5,49	0,023
Conti	H6	5,36	5,32	5,32	5,31	5,317	0,006	1,002	5,325	5,33	5,33	5,32	0,006
BS	H7	5,60	5,56	5,57	5,53	5,553	0,021	1,003	5,569	5,58	5,59	5,55	0,021
Pi	H8	5,40	5,38	5,35	5,30	5,343	0,040	1,006	5,375	5,41	5,38	5,33	0,041
RDW	H9	5,49	5,53	5,58	5,51	5,540	0,036	1,000	5,542	5,53	5,58	5,51	0,036
									5,358				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	J0	5,62	5,62	5,59	5,60	5,603	0,015	1,001	5,608	5,62	5,59	5,60	0,015
UTAC	J1	5,60	5,61	5,60	5,59	5,600	0,010	1,004	5,625	5,64	5,62	5,62	0,010
Idiada	J2	5,93	5,94	5,90	5,87	5,903	0,035	1,001	5,912	5,95	5,91	5,88	0,035
Mi	J3	5,67	5,66	5,62	5,60	5,627	0,031	0,994	5,592	5,63	5,59	5,57	0,030
JASIC	J4	5,63	5,61	5,60	5,59	5,600	0,010	0,988	5,530	5,54	5,53	5,52	0,010
GY	J5	5,96	5,95	5,93	5,91	5,930	0,020	0,989	5,863	5,88	5,86	5,84	0,020
Conti	J6	5,72	5,68	5,66	5,64	5,660	0,020	0,999	5,655	5,67	5,66	5,64	0,020
BS	J7	5,93	5,90	5,88	5,87	5,883	0,015	0,999	5,878	5,89	5,87	5,86	0,015
Pi	J8	5,52	5,50	5,50	5,48	5,493	0,012	1,013	5,567	5,57	5,57	5,55	0,012
RDW	J9	5,68	5,68	5,64	5,65	5,657	0,021	1,012	5,722	5,75	5,71	5,72	0,021
									5,695				

										Corrected individ values 2-4			
	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	2	3	4	sigma
TÜV	K0	7,08	7,08	7,11	7,11	7,100	0,017	1,002	7,114	7,09	7,12	7,12	0,017
UTAC	K1	7,07	7,07	7,06	7,05	7,058	0,010	1,002	7,075	7,08	7,08	7,06	0,010
Idiada	K2	7,37	7,35	7,35	7,35	7,350	0,000	0,994	7,308	7,31	7,31	7,31	0,000
Mi	K3	6,87	6,85	6,85	6,83	6,843	0,012	1,006	6,886	6,89	6,89	6,87	0,012
JASIC	K4	6,83	6,80	6,89	6,79	6,827	0,055	1,001	6,833	6,81	6,90	6,80	0,055
GY	K5	7,39	7,39	7,42	7,40	7,403	0,015	1,005	7,442	7,43	7,46	7,44	0,015
Conti	K6	7,03	7,00	6,99	7,00	6,997	0,006	1,001	7,007	7,01	7,00	7,01	0,006
BS	K7	7,44	7,41	7,44	7,43	7,427	0,015	0,997	7,402	7,39	7,42	7,41	0,015
Pi	K8	6,97	6,99	6,98	7,07	7,013	0,049	0,999	7,007	6,98	6,97	7,06	0,049
RDW	K9	7,24	7,23	7,24	7,23	7,233	0,006	0,999	7,226	7,22	7,23	7,22	0,006
									7,130				

2. Qualification of reference machines

2.1. Sigma m for C1-C2 machines (based on corrected raw data)

Laboratory	Sigma X	Sigma A	Sigma B	Sigma C	Sigma D	Sigma E	**Sigma m**
Lab0	0,036	0,023	0,023	0,029	0,01	0,023	**0,024**
Lab1	0,017	0,015	0,018	0,03	0,025	0,032	**0,023**
Lab2	0,01	0,042	0,026	0,02	0,021	0,017	**0,023**
Lab3	0,017	0,01	0,025	0,018	0,011	0,041	**0,02**
Lab4	0,025	0,032	0,05	0,006	0,02	0,03	**0,027**
Lab5	0,025	0,032	0,01	0,041	0,025	0,038	**0,028**
Lab6	0,025	0,015	0,01	0,025	0,015	0,026	**0,019**
Lab7	0,01	0,02	0,01	0,02	0,012	0,017	**0,015**
Lab8	0,032	0,026	0,043	0,026	0,047	0,041	**0,036**
Lab9	0,006	0,03	0,032	0,031	0,034	0,041	**0,029**
Lab10	0,016	0,006	0,006	0,026	0,045	0,017	**0,019**

2.2. Sigma m for C3 machines (based on corrected raw data)

Laboratory	Sigma F	Sigma G	Sigma H	Sigma J	Sigma K	**Sigma m**
Lab0	0,006	0,010	0,030	0,015	0,017	**0,016**
Lab1	0,012	0,019	0,022	0,010	0,010	**0,015**
Lab2	0,015	0,000	0,042	0,035	0,000	**0,018**
Lab3	0,015	0,025	0,036	0,030	0,012	**0,024**
Lab4	0,006	0,000	0,017	0,010	0,055	**0,018**
Lab5	0,015	0,015	0,023	0,020	0,015	**0,018**
Lab6	0,006	0,015	0,006	0,020	0,006	**0,010**
Lab7	0,010	0,050	0,021	0,015	0,015	**0,022**
Lab8	0,006	0,041	0,041	0,012	0,049	**0,030**
Lab9	0,012	0,010	0,036	0,021	0,006	**0,017**

3. Statistical analysis of the Interlaboratories results – Cr (N/kN)

1. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre X

1.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	5.778	0.036	0.630	0.073
01	3	5.434	0.017	0.316	0.034
02	3	5.471	0.010	0.184	0.020
03	3	5.374	0.017	0.318	0.034
04	3	5.615	0.025	0.444	0.050
05	3	5.066	0.025	0.497	0.050
06	3	5.304	0.025	0.468	0.050
07	3	5.216	0.010	0.196	0.020
08	3	5.330	0.032	0.607	0.065
09	3	5.742	0.006	0.102	0.012
10	3	5.303	0.016	0.297	0.031

1.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
5.737	5.820	4.303	5.688
5.414	5.453	4.303	5.391
5.459	5.482	4.303	5.446
5.354	5.393	4.303	5.331
5.587	5.644	4.303	5.553
5.037	5.094	4.303	5.003
5.276	5.332	4.303	5.243
5.205	5.228	4.303	5.191
5.293	5.367	4.303	5.250
5.735	5.749	4.303	5.727
5.285	5.320	4.303	5.263

Confidence_interval_T_up	Demi_amplitude_T
5.869	0.090
5.476	0.043
5.496	0.025
5.416	0.043
5.677	0.062
5.128	0.063
5.366	0.062

Confidence_interval_T_up	Demi_amplitude_T
5.242	0.025
5.410	0.080
5.757	0.015
5.342	0.039

1.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	26.74	24.93
01	0.03	5.55
02	0.51	1.90
03	0.47	5.50
04	7.90	11.69
05	26.45	11.90
06	2.86	11.58
07	8.79	1.97
08	1.74	19.67
09	21.56	0.65
10	2.95	4.66

1.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	5.421
Repeatability_standard_deviat	0.022
Limit_of_repeatability	0.062
Repeatability_exp_uncertainty	0.044
Reproducibility_stand_deviat	0.219
Limit_of_reproducibility	0.614
Reproducibility_exp_uncertaint	0.438

1.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.81
Repro_exp_uncert_percent	8.09

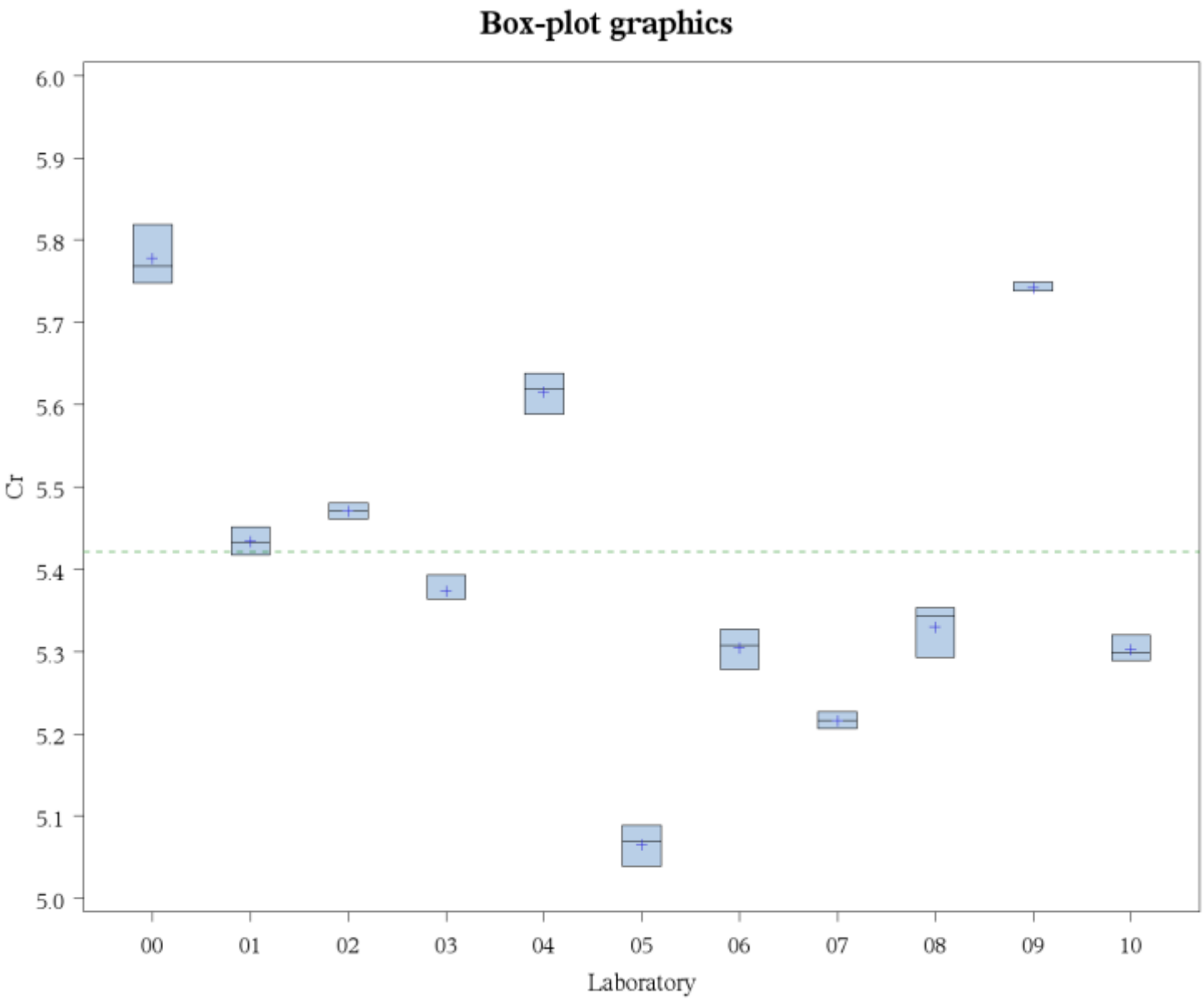
1.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.99

1.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	0.357	0.208	-0.051	0.766	NON
01	3	0.013	0.208	-0.396	0.421	NON
02	3	0.050	0.208	-0.359	0.458	NON
03	3	-0.048	0.208	-0.456	0.361	NON
04	3	0.194	0.208	-0.214	0.602	NON
05	3	-0.355	0.208	-0.764	0.053	NON
06	3	-0.117	0.208	-0.525	0.291	NON
07	3	-0.205	0.208	-0.613	0.204	NON
08	3	-0.091	0.208	-0.499	0.317	NON
09	3	0.321	0.208	-0.088	0.729	NON
10	3	-0.119	0.208	-0.527	0.290	NON

1.8. Box-plot graphics



2. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre A

2.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	6.395	0.023	0.359	0.046
01	3	6.125	0.015	0.245	0.030
02	3	6.147	0.042	0.677	0.083
03	3	6.164	0.010	0.163	0.020
04	3	6.251	0.032	0.515	0.064
05	3	5.779	0.032	0.561	0.065
06	3	5.954	0.015	0.255	0.030
07	3	5.910	0.020	0.341	0.040
08	3	6.017	0.026	0.440	0.053
09	3	6.292	0.030	0.479	0.060
10	3	5.877	0.006	0.099	0.012

2.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
6.369	6.421	4.303	6.338
6.108	6.142	4.303	6.088
6.100	6.194	4.303	6.043
6.153	6.176	4.303	6.140
6.214	6.287	4.303	6.171
5.743	5.816	4.303	5.699
5.937	5.971	4.303	5.916
5.888	5.933	4.303	5.860
5.987	6.047	4.303	5.952
6.258	6.327	4.303	6.218
5.870	5.884	4.303	5.863

Confidence_interval_T_up	Demi_amplitude_T
6.452	0.057
6.162	0.037
6.250	0.103
6.189	0.025
6.331	0.080
5.860	0.081
5.991	0.038

Confidence_interval_T_up	Demi_amplitude_T
5.961	0.050
6.083	0.066
6.367	0.075
5.891	0.014

2.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	26.51	7.59
01	0.48	3.23
02	1.11	24.93
03	1.81	1.44
04	7.68	14.88
05	25.09	15.10
06	4.55	3.32
07	8.10	5.85
08	1.17	10.09
09	11.96	13.08
10	11.54	0.48

2.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	6.083
Repeatability_standard_deviat	0.025
Limit_of_repeatability	0.070
Repeatability_exp_uncertainty	0.050
Reproducibility_stand_deviat	0.193
Limit_of_reproducibility	0.540
Reproducibility_exp_uncertaint	0.385

2.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.83
Repro_exp_uncert_percent	6.34

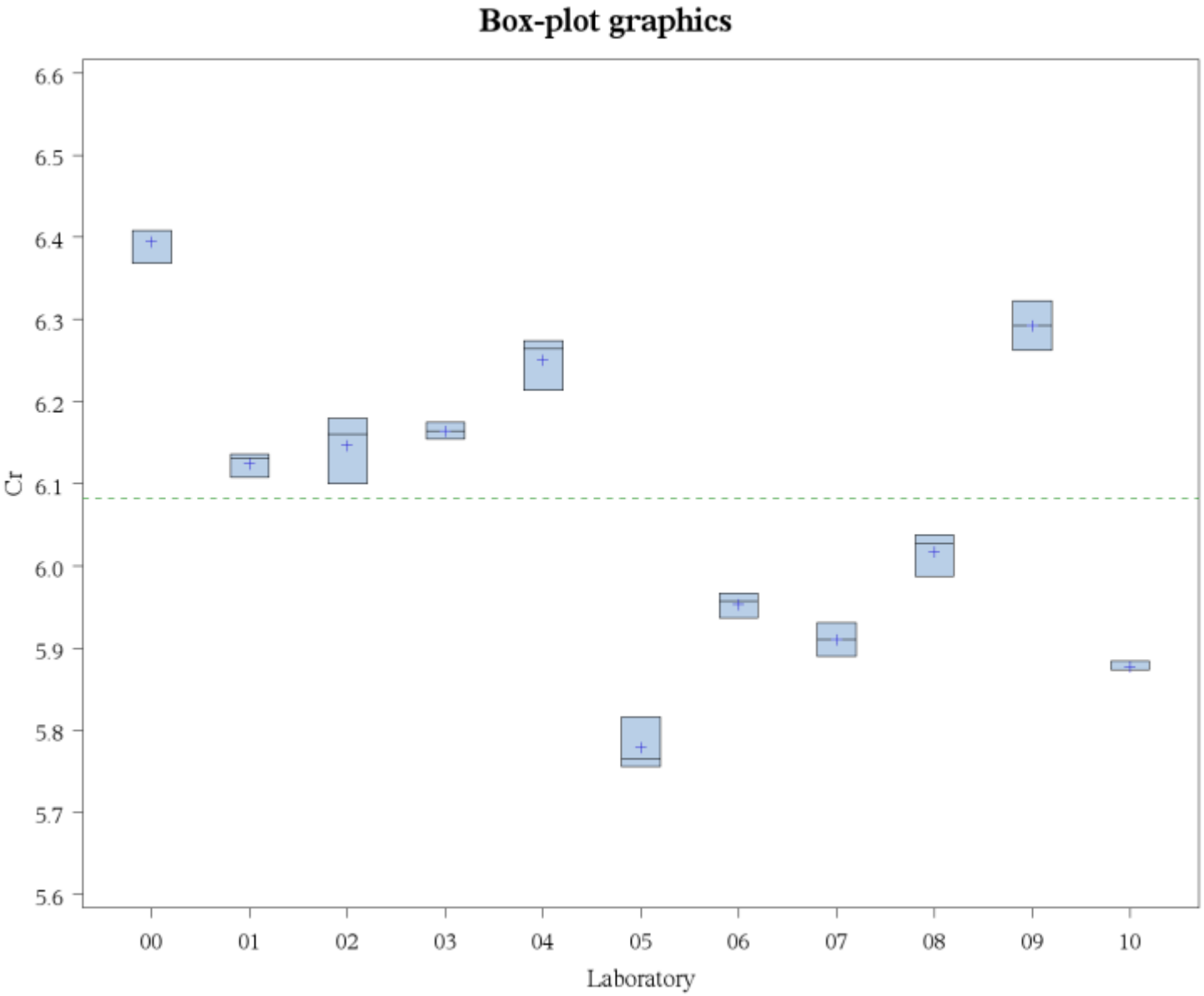
2.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.30

2.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	0.312	0.183	-0.046	0.670	NON
01	3	0.042	0.183	-0.316	0.400	NON
02	3	0.064	0.183	-0.294	0.422	NON
03	3	0.082	0.183	-0.277	0.440	NON
04	3	0.168	0.183	-0.190	0.526	NON
05	3	-0.303	0.183	-0.662	0.055	NON
06	3	-0.129	0.183	-0.487	0.229	NON
07	3	-0.172	0.183	-0.530	0.186	NON
08	3	-0.066	0.183	-0.424	0.292	NON
09	3	0.210	0.183	-0.148	0.568	NON
10	3	-0.206	0.183	-0.564	0.152	NON

2.8. Box-plot graphics



3. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre B

3.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	6.789	0.023	0.340	0.046
01	3	6.879	0.018	0.255	0.035
02	3	6.643	0.026	0.396	0.053
03	3	6.663	0.025	0.378	0.050
04	3	6.704	0.050	0.748	0.100
05	3	6.286	0.010	0.160	0.020
06	3	6.377	0.010	0.155	0.020
07	3	6.332	0.010	0.157	0.020
08	3	6.431	0.043	0.674	0.087
09	3	6.804	0.032	0.471	0.064
10	3	6.554	0.006	0.088	0.012

3.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
6.762	6.815	4.303	6.731
6.860	6.899	4.303	6.836
6.614	6.673	4.303	6.578
6.635	6.692	4.303	6.601
6.647	6.761	4.303	6.580
6.275	6.298	4.303	6.261
6.366	6.389	4.303	6.353
6.321	6.343	4.303	6.307
6.382	6.480	4.303	6.323
6.768	6.840	4.303	6.724
6.547	6.560	4.303	6.539

Confidence_interval_T_up	Demi_amplitude_T
6.846	0.057
6.923	0.043
6.709	0.065
6.726	0.063
6.829	0.125
6.311	0.025
6.402	0.025
6.357	0.025
6.539	0.108

Confidence_interval_T_up	Demi_amplitude_T
6.883	0.080
6.568	0.014

3.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	9.60	6.72
01	20.25	3.87
02	0.74	8.74
03	1.36	8.02
04	3.23	31.78
05	21.56	1.27
06	10.50	1.24
07	15.53	1.25
08	5.82	23.71
09	11.12	12.96
10	0.27	0.42

3.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	6.588
Repeatability_standard_deviat	0.027
Limit_of_repeatability	0.075
Repeatability_exp_uncertainty	0.054
Reproducibility_stand_deviat	0.206
Limit_of_reproducibility	0.578
Reproducibility_exp_uncertaint	0.413

3.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.81
Repro_exp_uncert_percent	6.26

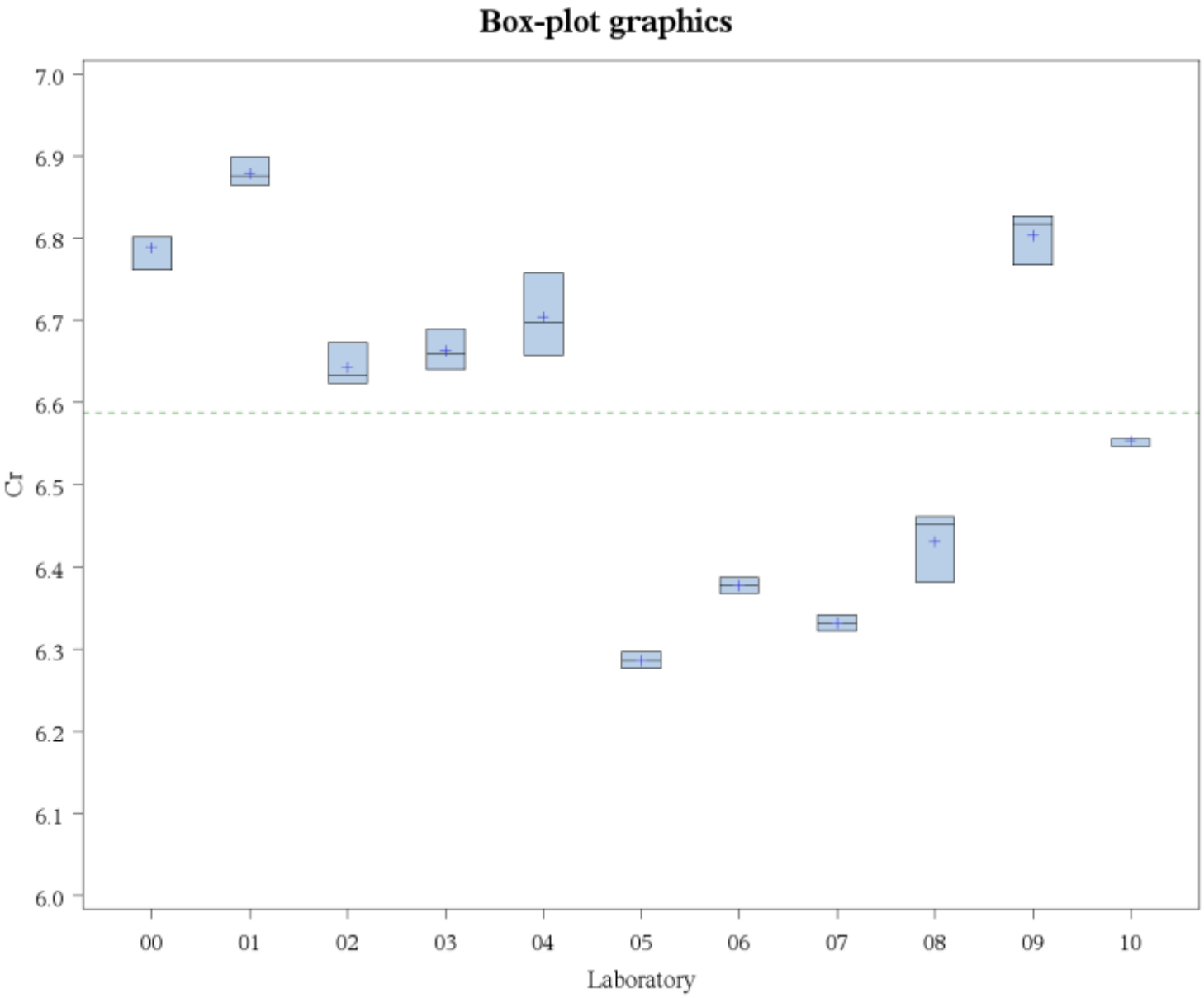
3.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.31

3.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	0.201	0.196	-0.182	0.584	NON
01	3	0.292	0.196	-0.091	0.675	NON
02	3	0.056	0.196	-0.327	0.439	NON
03	3	0.076	0.196	-0.308	0.459	NON
04	3	0.117	0.196	-0.267	0.500	NON
05	3	-0.301	0.196	-0.685	0.082	NON
06	3	-0.210	0.196	-0.593	0.173	NON
07	3	-0.256	0.196	-0.639	0.128	NON
08	3	-0.156	0.196	-0.540	0.227	NON
09	3	0.216	0.196	-0.167	0.600	NON
10	3	-0.034	0.196	-0.417	0.349	NON

3.8. Box-plot graphics



4. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre C

4.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	7.827	0.029	0.367	0.058
01	3	7.800	0.030	0.389	0.061
02	3	7.716	0.020	0.261	0.040
03	3	7.682	0.018	0.228	0.035
04	3	7.780	0.006	0.074	0.012
05	3	7.298	0.041	0.556	0.081
06	3	7.519	0.025	0.336	0.050
07	3	7.578	0.020	0.266	0.040
08	3	7.370	0.026	0.357	0.053
09	3	7.790	0.031	0.392	0.061
10	3	7.370	0.026	0.354	0.052

4.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low	Confidence_interval_T_up	Demi_amplitude_T
7.794	7.860	4.303	7.756	7.898	0.071
7.766	7.835	4.303	7.725	7.876	0.075
7.693	7.739	4.303	7.666	7.766	0.050
7.662	7.701	4.303	7.638	7.725	0.044
7.774	7.787	4.303	7.766	7.795	0.014
7.252	7.344	4.303	7.198	7.399	0.101
7.491	7.548	4.303	7.457	7.582	0.063
7.556	7.601	4.303	7.528	7.628	0.050
7.340	7.400	4.303	7.305	7.435	0.065
7.756	7.825	4.303	7.714		
7.341	7.400	4.303	7.305		

Confidence_interval_T_up	Demi_amplitude_T
7.866	0.076
7.435	0.065

4.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	12.09	11.05
01	9.28	12.29
02	2.82	5.42
03	1.26	4.10
04	7.40	0.45
05	25.72	21.97
06	2.25	8.51
07	0.29	5.41
08	15.28	9.22
09	8.31	12.48
10	15.29	9.10

4.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	7.612
Repeatability_standard_deviat	0.026
Limit_of_repeatability	0.073
Repeatability_exp_uncertainty	0.052
Reproducibility_stand_deviat	0.197
Limit_of_reproducibility	0.551
Reproducibility_exp_uncertaint	0.393

4.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.69
Repro_exp_uncert_percent	5.17

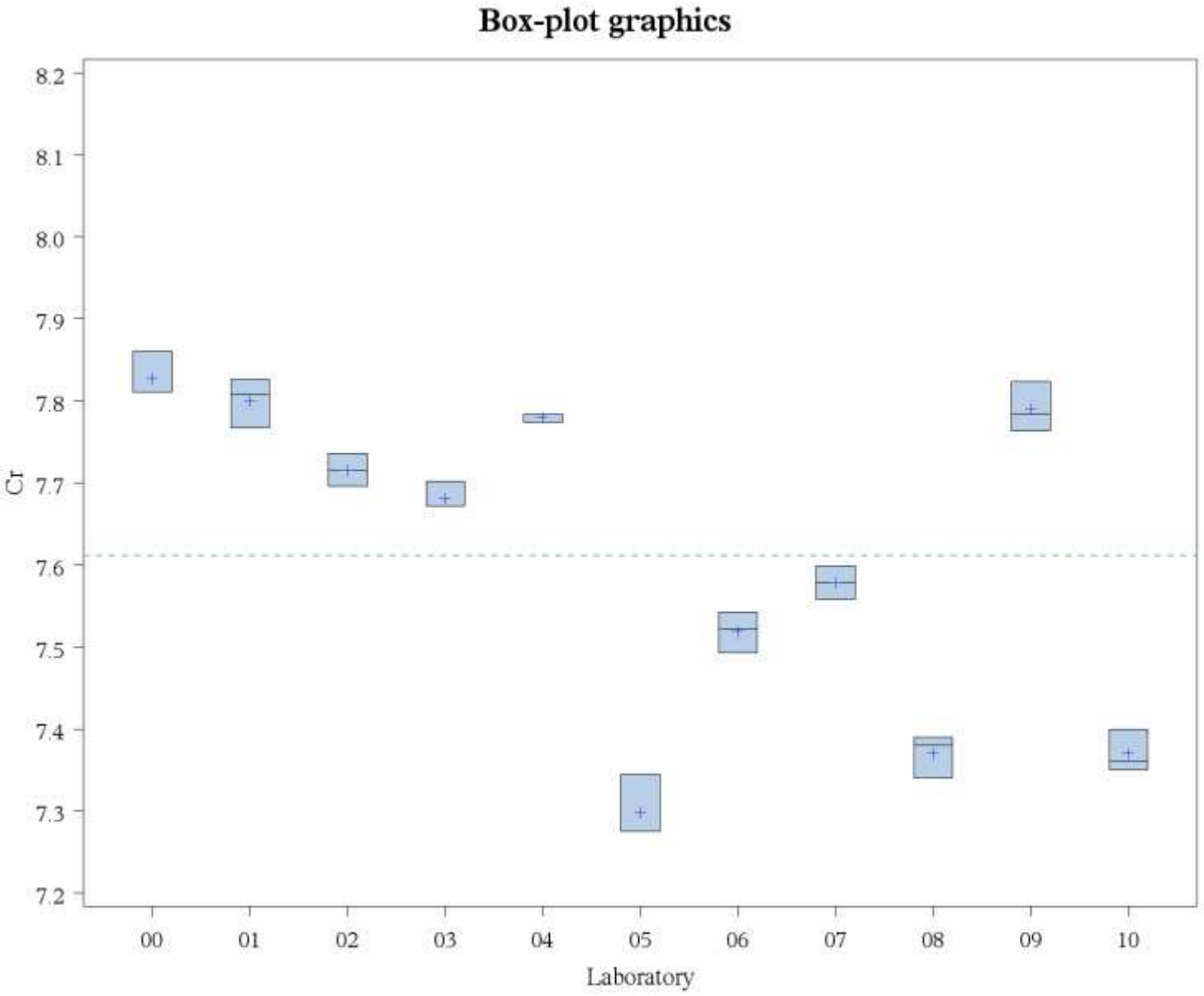
4.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.24

4.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	0.215	0.186	-0.150	0.581	NON
01	3	0.188	0.186	-0.177	0.554	NON
02	3	0.104	0.186	-0.262	0.469	NON
03	3	0.070	0.186	-0.296	0.435	NON
04	3	0.168	0.186	-0.197	0.534	NON
05	3	-0.314	0.186	-0.679	0.052	NON
06	3	-0.093	0.186	-0.458	0.273	NON
07	3	-0.034	0.186	-0.399	0.332	NON
08	3	-0.242	0.186	-0.607	0.124	NON
09	3	0.178	0.186	-0.187	0.544	NON
10	3	-0.242	0.186	-0.607	0.124	NON

4.8. Box-plot graphics



5. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre D

5.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	8.676	0.010	0.115	0.020
01	3	8.587	0.025	0.289	0.050
02	3	8.456	0.021	0.246	0.042
03	3	8.617	0.011	0.133	0.023
04	3	8.706	0.020	0.230	0.040
05	3	8.374	0.025	0.302	0.051
06	3	8.555	0.015	0.179	0.031
07	3	8.499	0.012	0.136	0.023
08	3	8.227	0.047	0.574	0.094
09	3	8.602	0.034	0.399	0.069
10	3	8.486	0.045	0.528	0.090

5.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
8.665	8.688	4.303	8.652
8.559	8.615	4.303	8.525
8.432	8.480	4.303	8.404
8.604	8.630	4.303	8.589
8.684	8.729	4.303	8.657
8.345	8.402	4.303	8.311
8.538	8.573	4.303	8.517
8.486	8.512	4.303	8.471
8.174	8.280	4.303	8.110
8.563	8.641	4.303	8.517
8.435	8.536	4.303	8.374

Confidence_interval_T_up	Demi_amplitude_T
8.701	0.025
8.648	0.062
8.508	0.052
8.646	0.029
8.756	0.050
8.437	0.063
8.593	0.038
8.528	0.029
8.344	0.117

Confidence_interval_T_up	Demi_amplitude_T
8.687	0.085
8.597	0.111

5.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	11.69	1.23
01	1.91	7.59
02	2.53	5.35
03	4.31	1.63
04	16.77	4.93
05	11.95	7.89
06	0.44	2.90
07	0.37	1.65
08	46.19	27.51
09	2.99	14.55
10	0.85	24.77

5.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	8.526
Repeatability_standard_deviat	0.027
Limit_of_repeatability	0.076
Repeatability_exp_uncertainty	0.054
Reproducibility_stand_deviat	0.141
Limit_of_reproducibility	0.395
Reproducibility_exp_uncertaint	0.282

5.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.64
Repro_exp_uncert_percent	3.31

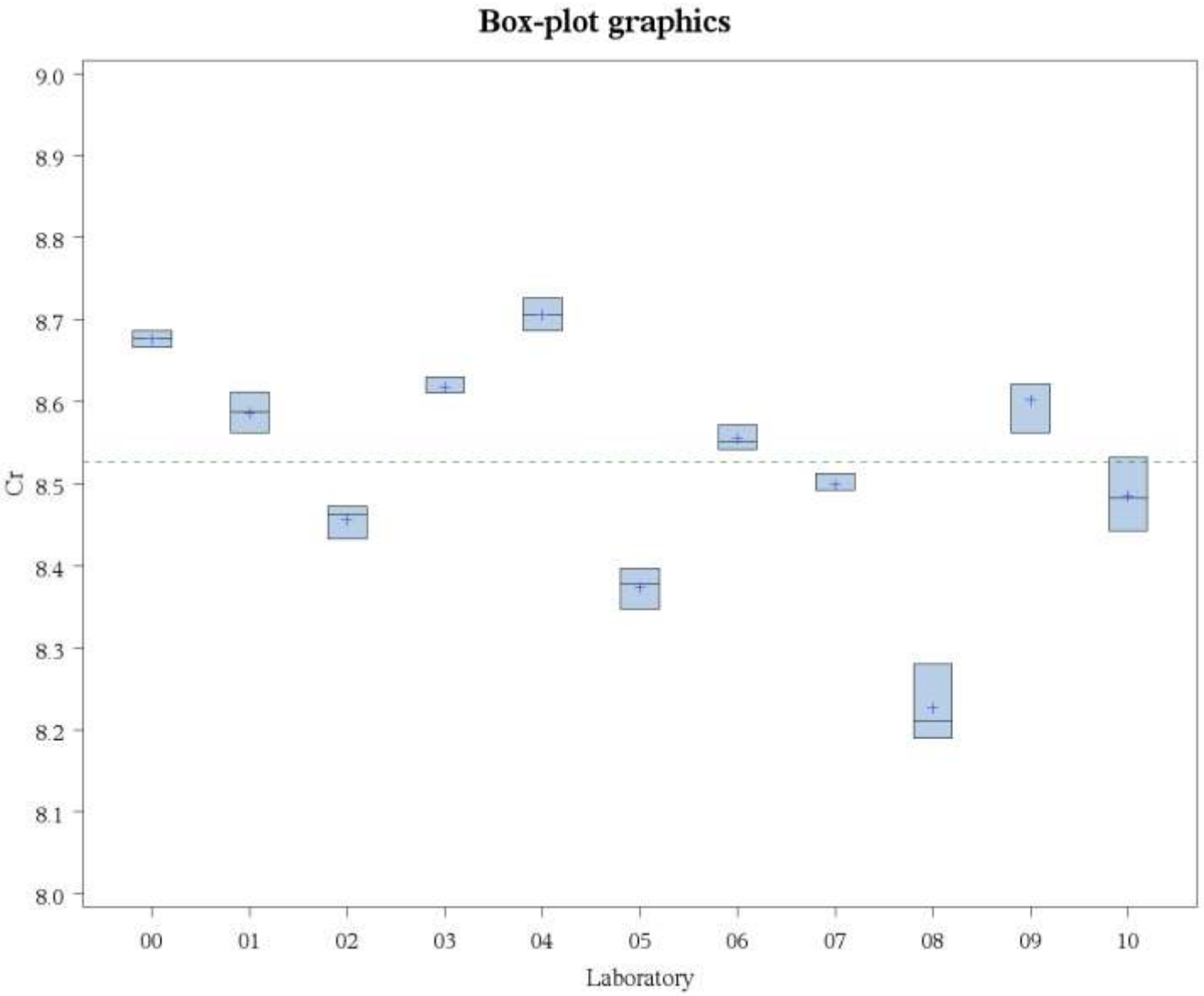
5.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	96.29

5.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	0.150	0.133	-0.110	0.411	NON
01	3	0.061	0.133	-0.199	0.321	NON
02	3	-0.070	0.133	-0.330	0.190	NON
03	3	0.091	0.133	-0.169	0.351	NON
04	3	0.180	0.133	-0.080	0.440	NON
05	3	-0.152	0.133	-0.412	0.108	NON
06	3	0.029	0.133	-0.231	0.289	NON
07	3	-0.027	0.133	-0.287	0.233	NON
08	3	-0.299	0.133	-0.559	-0.039	OUI
09	3	0.076	0.133	-0.184	0.336	NON
10	3	-0.040	0.133	-0.301	0.220	NON

5.8. Box-plot graphics



6. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre E

6.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	10.532	0.023	0.221	0.046
01	3	10.037	0.032	0.316	0.063
02	3	9.877	0.017	0.174	0.034
03	3	9.989	0.041	0.408	0.082
04	3	10.139	0.030	0.301	0.061
05	3	9.838	0.038	0.381	0.075
06	3	9.951	0.026	0.262	0.052
07	3	9.910	0.017	0.174	0.035
08	3	10.079	0.041	0.404	0.081
09	3	10.364	0.041	0.392	0.081
10	3	9.976	0.017	0.174	0.035

6.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
10.506	10.559	4.303	10.475
10.001	10.072	4.303	9.958
9.858	9.897	4.303	9.835
9.942	10.035	4.303	9.887
10.105	10.174	4.303	10.064
9.796	9.881	4.303	9.745
9.922	9.981	4.303	9.886
9.890	9.930	4.303	9.867
10.033	10.125	4.303	9.978
10.318	10.410	4.303	10.263
9.956	9.996	4.303	9.933

Confidence_interval_T_up	Demi_amplitude_T
10.590	0.058
10.115	0.079
9.920	0.043
10.090	0.101
10.215	0.076
9.932	0.093
10.016	0.065
9.953	0.043
10.181	0.101

Confidence_interval_T_up	Demi_amplitude_T
10.465	0.101
10.019	0.043

6.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	48.74	5.18
01	0.16	9.64
02	7.62	2.84
03	1.23	15.93
04	1.29	8.90
05	11.17	13.50
06	2.77	6.54
07	5.18	2.86
08	0.06	15.90
09	20.10	15.83
10	1.68	2.89

6.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	10.063
Repeatability_standard_deviat	0.031
Limit_of_repeatability	0.086
Repeatability_exp_uncertainty	0.062
Reproducibility_stand_deviat	0.214
Limit_of_reproducibility	0.599
Reproducibility_exp_uncertaint	0.428

6.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.61
Repro_exp_uncert_percent	4.25

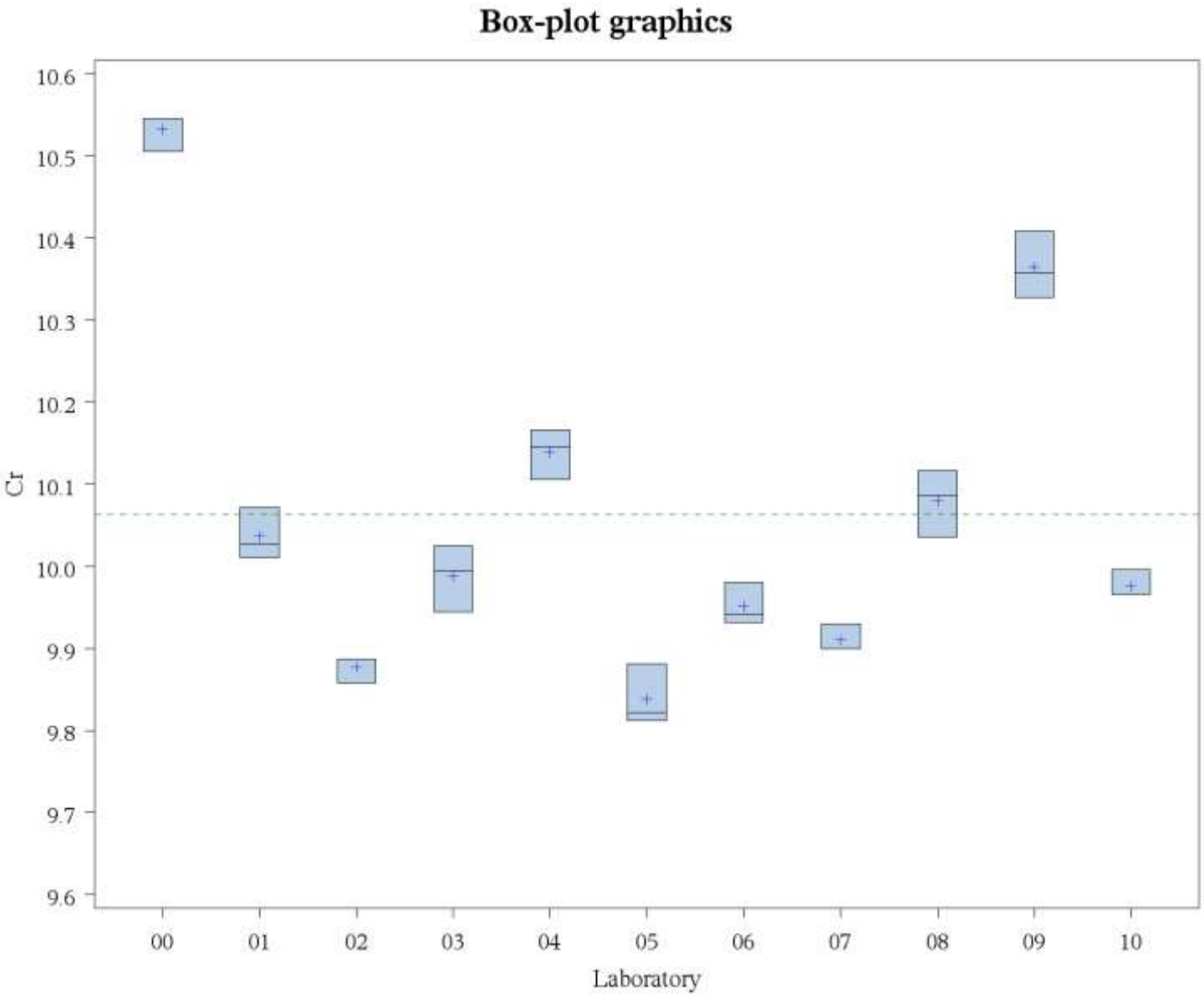
6.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	97.93

6.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	0.469	0.203	0.072	0.866	OUI
01	3	-0.026	0.203	-0.424	0.371	NON
02	3	-0.186	0.203	-0.583	0.212	NON
03	3	-0.074	0.203	-0.472	0.323	NON
04	3	0.076	0.203	-0.321	0.473	NON
05	3	-0.225	0.203	-0.622	0.173	NON
06	3	-0.112	0.203	-0.509	0.285	NON
07	3	-0.153	0.203	-0.550	0.244	NON
08	3	0.016	0.203	-0.381	0.414	NON
09	3	0.301	0.203	-0.096	0.698	NON
10	3	-0.087	0.203	-0.484	0.310	NON

6.8. Box-plot graphics



8. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre F

8.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	3.585	0.006	0.161	0.012
01	3	3.620	0.012	0.342	0.025
02	3	3.781	0.015	0.406	0.031
03	3	3.498	0.015	0.436	0.031
04	3	3.475	0.006	0.167	0.012
05	3	3.728	0.015	0.409	0.030
06	3	3.555	0.006	0.162	0.012
07	3	3.774	0.010	0.265	0.020
08	3	3.554	0.006	0.162	0.012
09	3	3.661	0.012	0.315	0.023

8.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
3.578	3.591	4.303	3.571
3.606	3.634	4.303	3.589
3.763	3.798	4.303	3.743
3.481	3.515	4.303	3.460
3.469	3.482	4.303	3.461
3.710	3.745	4.303	3.690
3.548	3.561	4.303	3.540
3.763	3.786	4.303	3.749
3.548	3.561	4.303	3.540
3.648	3.674	4.303	3.632

Confidence_interval_T_up	Demi_amplitude_T
3.599	0.014
3.651	0.031
3.819	0.038
3.536	0.038
3.490	0.014
3.766	0.038
3.569	0.014
3.799	0.025
3.568	0.014
3.690	0.029

8.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	1.35	2.71
01	0.01	12.57
02	22.93	19.31
03	14.44	19.07
04	20.10	2.77
05	10.09	19.04
06	4.30	2.72
07	21.07	8.17
08	4.39	2.73
09	1.33	10.90

8.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	3.623
Repeatability_standard_deviat	0.011
Limit_of_repeatability	0.031
Repeatability_exp_uncertainty	0.022
Reproducibility_stand_deviat	0.110
Limit_of_reproducibility	0.308
Reproducibility_exp_uncertaint	0.220

8.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.61
Repro_exp_uncert_percent	6.08

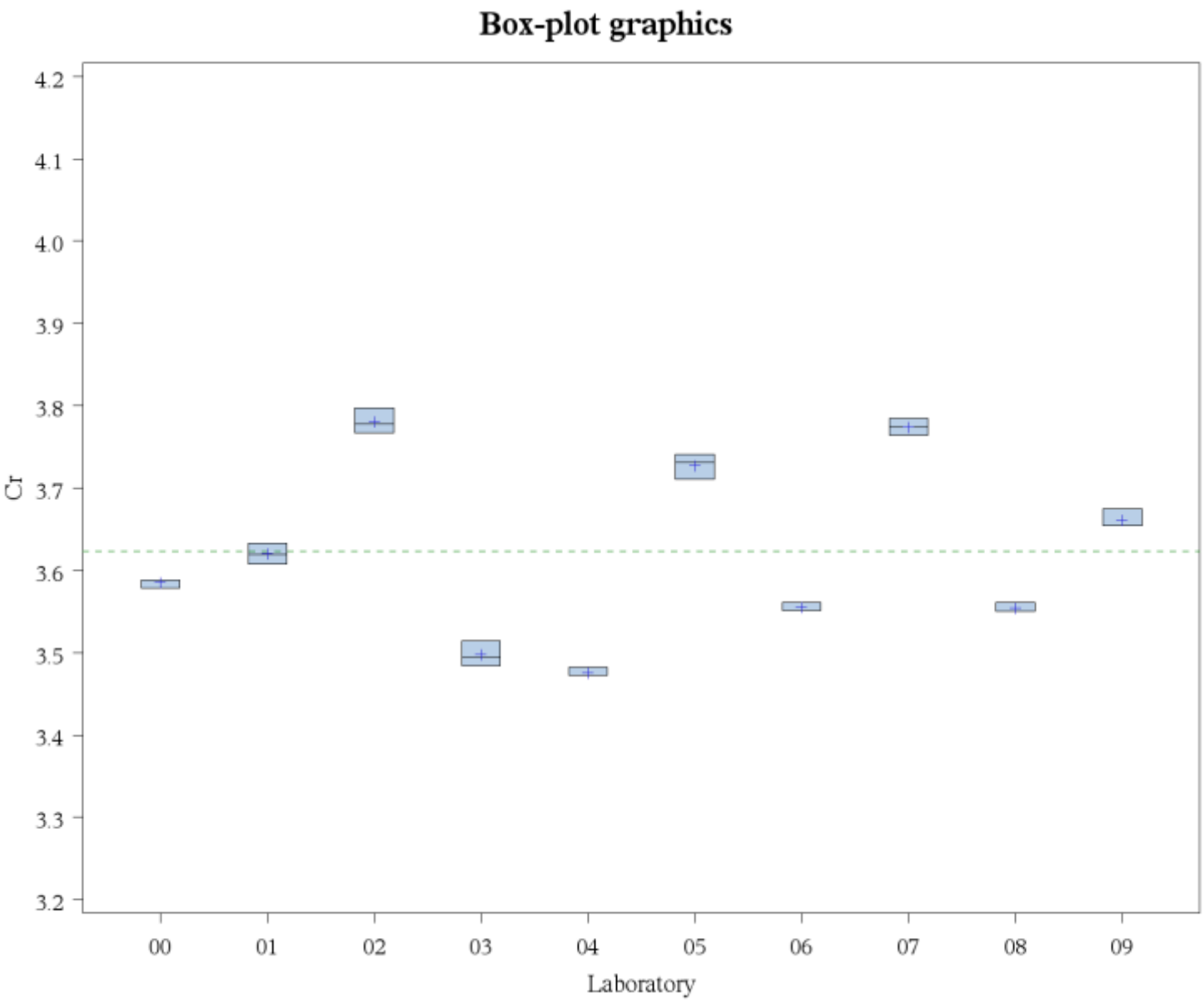
8.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.99

8.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	-0.038	0.104	-0.242	0.166	NON
01	3	-0.003	0.104	-0.207	0.201	NON
02	3	0.158	0.104	-0.046	0.362	NON
03	3	-0.125	0.104	-0.329	0.079	NON
04	3	-0.148	0.104	-0.352	0.056	NON
05	3	0.105	0.104	-0.099	0.309	NON
06	3	-0.068	0.104	-0.272	0.136	NON
07	3	0.151	0.104	-0.053	0.355	NON
08	3	-0.069	0.104	-0.273	0.135	NON
09	3	0.038	0.104	-0.166	0.242	NON

8.8. Box-plot graphics



9. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre G

9.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	4.407	0.010	0.227	0.020
01	3	4.400	0.019	0.424	0.037
02	3	4.764	0.000	0.000	0.000
03	3	4.416	0.025	0.563	0.050
04	3	4.318	0.000	0.000	0.000
05	3	4.586	0.015	0.333	0.031
06	3	4.413	0.015	0.342	0.030
07	3	4.716	0.050	1.060	0.100
08	3	4.489	0.041	0.905	0.081
09	3	4.496	0.010	0.219	0.020

9.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
4.395	4.418	4.303	4.382
4.379	4.422	4.303	4.354
4.764	4.764	4.303	4.764
4.388	4.445	4.303	4.355
4.318	4.318	4.303	4.318
4.569	4.604	4.303	4.548
4.396	4.430	4.303	4.376
4.660	4.773	4.303	4.592
4.443	4.534	4.303	4.388
4.485	4.508	4.303	4.472

Confidence_interval_T_up	Demi_amplitude_T
4.431	0.025
4.447	0.046
4.764	0.000
4.478	0.062
4.318	0.000
4.624	0.038
4.451	0.038
4.841	0.124
4.589	0.101
4.521	0.024

9.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	4.63	1.73
01	5.26	6.04
02	36.39	0.00
03	3.72	10.71
04	17.59	0.00
05	3.86	4.04
06	4.02	3.95
07	24.44	43.28
08	0.08	28.58
09	0.01	1.68

9.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	4.501
Repeatability_standard_deviat	0.024
Limit_of_repeatability	0.067
Repeatability_exp_uncertainty	0.048
Reproducibility_stand_deviat	0.147
Limit_of_reproducibility	0.411
Reproducibility_exp_uncertaint	0.294

9.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	1.07
Repro_exp_uncert_percent	6.52

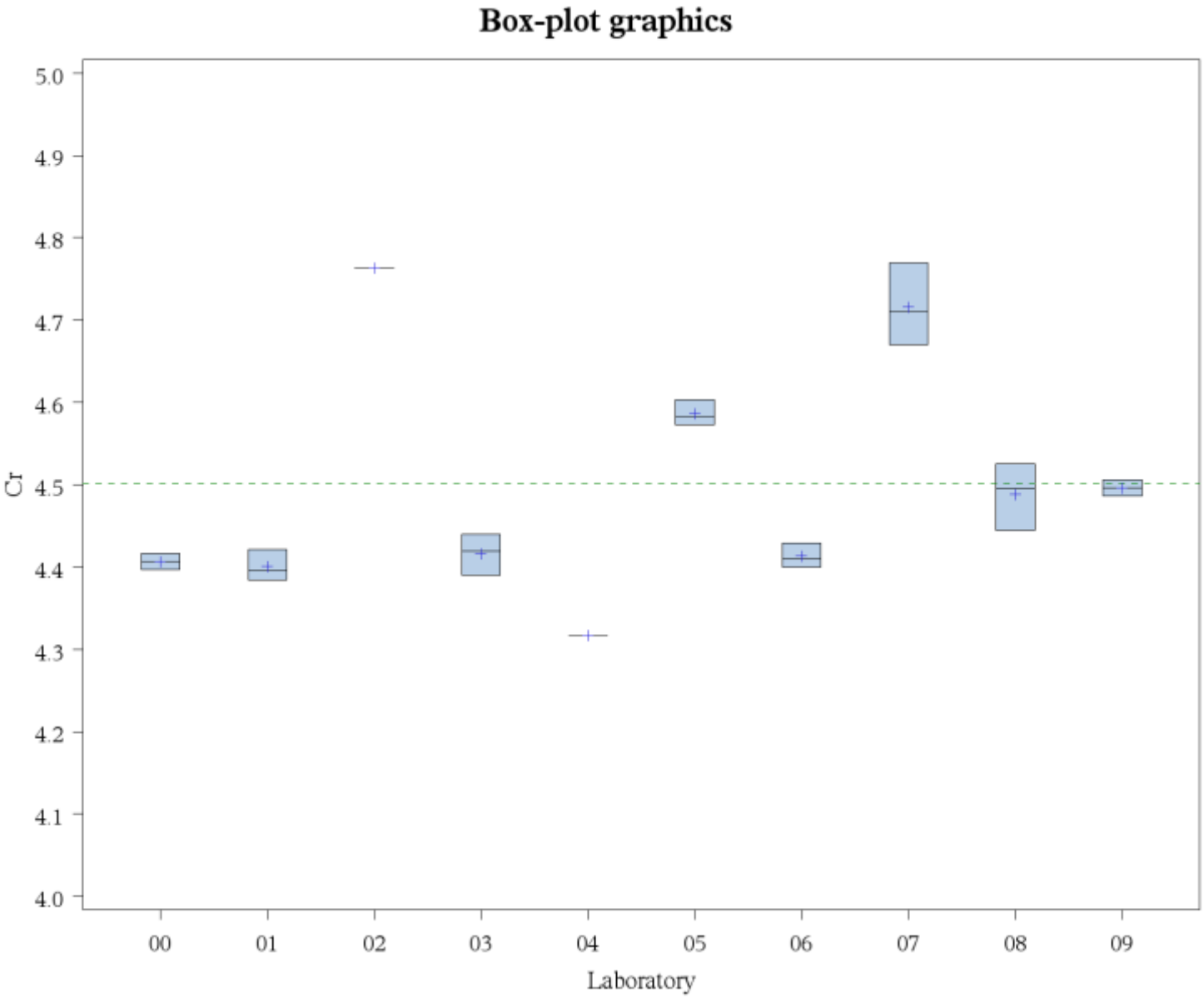
9.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	97.32

9.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	-0.094	0.138	-0.364	0.177	NON
01	3	-0.100	0.138	-0.371	0.170	NON
02	3	0.263	0.138	-0.007	0.534	NON
03	3	-0.084	0.138	-0.355	0.186	NON
04	3	-0.183	0.138	-0.454	0.087	NON
05	3	0.086	0.138	-0.185	0.356	NON
06	3	-0.087	0.138	-0.358	0.183	NON
07	3	0.216	0.138	-0.055	0.486	NON
08	3	-0.012	0.138	-0.283	0.258	NON
09	3	-0.004	0.138	-0.275	0.266	NON

9.8. Box-plot graphics



10. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre H

10.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	5.100	0.030	0.585	0.060
01	3	5.182	0.022	0.431	0.045
02	3	5.588	0.042	0.746	0.083
03	3	5.239	0.036	0.685	0.072
04	3	5.143	0.017	0.336	0.035
05	3	5.519	0.023	0.421	0.046
06	3	5.325	0.006	0.109	0.012
07	3	5.569	0.021	0.375	0.042
08	3	5.375	0.041	0.756	0.081
09	3	5.542	0.036	0.651	0.072

10.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
5.066	5.134	4.303	5.026
5.157	5.208	4.303	5.127
5.541	5.636	4.303	5.485
5.198	5.280	4.303	5.150
5.123	5.162	4.303	5.100
5.493	5.545	4.303	5.461
5.318	5.331	4.303	5.311
5.545	5.592	4.303	5.517
5.329	5.421	4.303	5.274
5.501	5.583	4.303	5.452

Confidence_interval_T_up	Demi_amplitude_T
5.174	0.074
5.238	0.055
5.692	0.104
5.328	0.089
5.185	0.043
5.577	0.058
5.339	0.014
5.621	0.052
5.476	0.101
5.631	0.090

10.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	21.03	10.25
01	9.77	5.75
02	16.76	20.02
03	4.48	14.87
04	14.68	3.44
05	8.17	6.22
06	0.35	0.39
07	14.01	5.02
08	0.09	19.05
09	10.64	15.00

10.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	5.358
Repeatability_standard_deviat	0.029
Limit_of_repeatability	0.082
Repeatability_exp_uncertainty	0.059
Reproducibility_stand_deviat	0.189
Limit_of_reproducibility	0.529
Reproducibility_exp_uncertaint	0.378

10.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	1.10
Repro_exp_uncert_percent	7.06

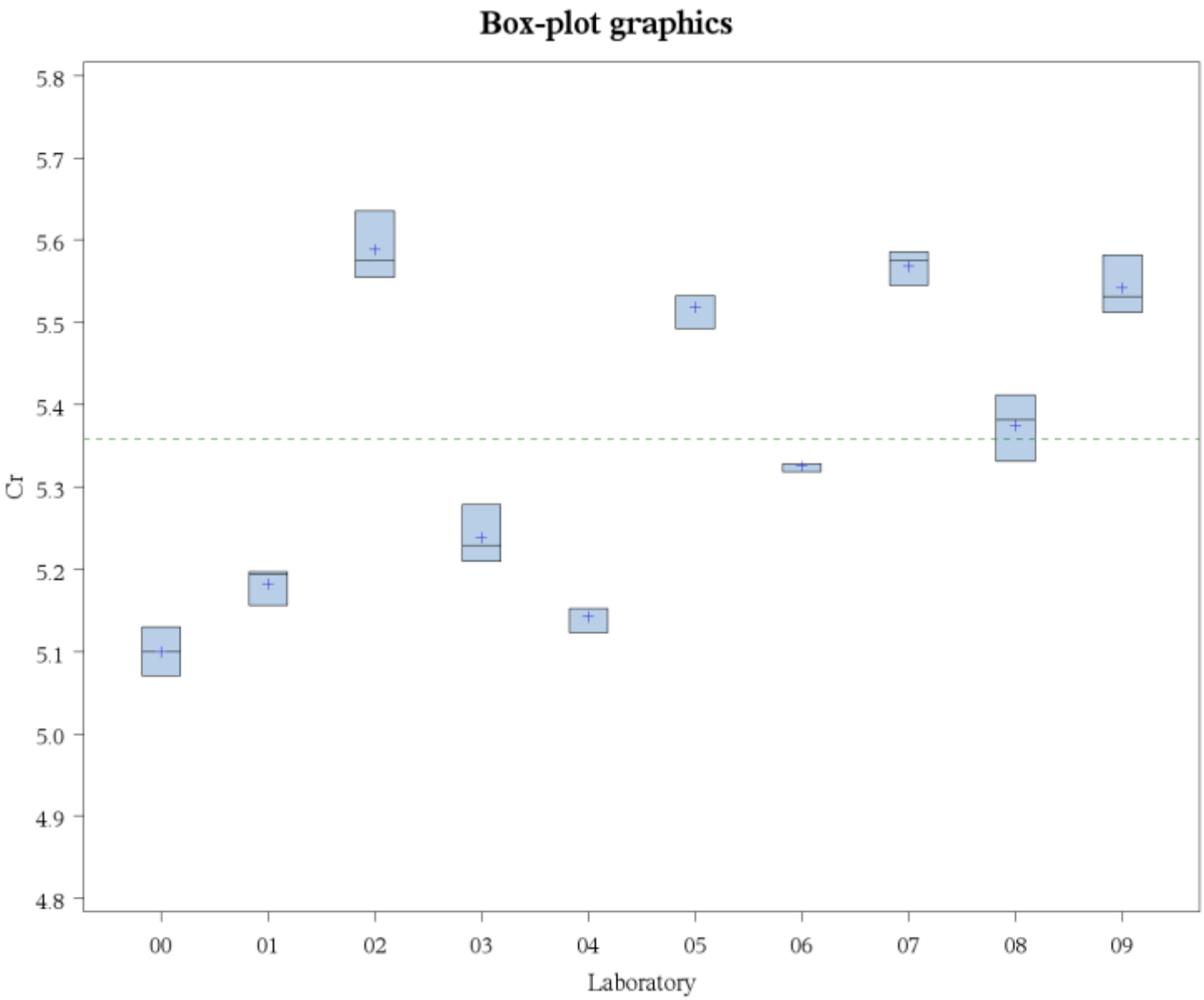
10.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	97.57

10.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	-0.258	0.178	-0.607	0.091	NON
01	3	-0.176	0.178	-0.525	0.173	NON
02	3	0.230	0.178	-0.118	0.579	NON
03	3	-0.119	0.178	-0.468	0.230	NON
04	3	-0.216	0.178	-0.564	0.133	NON
05	3	0.161	0.178	-0.188	0.509	NON
06	3	-0.033	0.178	-0.382	0.315	NON
07	3	0.211	0.178	-0.138	0.559	NON
08	3	0.017	0.178	-0.332	0.365	NON
09	3	0.184	0.178	-0.165	0.532	NON

10.8. Box-plot graphics



11. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre J

11.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	5.608	0.015	0.273	0.031
01	3	5.625	0.010	0.186	0.021
02	3	5.912	0.035	0.595	0.070
03	3	5.592	0.030	0.543	0.061
04	3	5.530	0.010	0.179	0.020
05	3	5.863	0.020	0.337	0.040
06	3	5.655	0.020	0.353	0.040
07	3	5.878	0.015	0.260	0.031
08	3	5.567	0.012	0.210	0.023
09	3	5.722	0.021	0.368	0.042

11.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
5.591	5.626	4.303	5.570
5.613	5.637	4.303	5.599
5.872	5.952	4.303	5.825
5.558	5.626	4.303	5.517
5.519	5.541	4.303	5.506
5.840	5.885	4.303	5.814
5.632	5.678	4.303	5.605
5.861	5.895	4.303	5.840
5.554	5.580	4.303	5.538
5.698	5.746	4.303	5.670

Confidence_interval_T_up	Demi_amplitude_T
5.646	0.038
5.651	0.026
5.999	0.087
5.668	0.075
5.555	0.025
5.912	0.049
5.705	0.050
5.916	0.038
5.596	0.029
5.775	0.052

11.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	4.26	5.56
01	2.79	2.60
02	26.44	29.43
03	5.98	21.93
04	15.36	2.32
05	15.78	9.30
06	0.91	9.50
07	18.82	5.54
08	9.25	3.26
09	0.41	10.55

11.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	5.695
Repeatability_standard_deviat	0.021
Limit_of_repeatability	0.057
Repeatability_exp_uncertainty	0.041
Reproducibility_stand_deviat	0.142
Limit_of_reproducibility	0.396
Reproducibility_exp_uncertaint	0.283

11.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.72
Repro_exp_uncert_percent	4.97

11.6. Part of variation in percent of the laboratories on the total variation

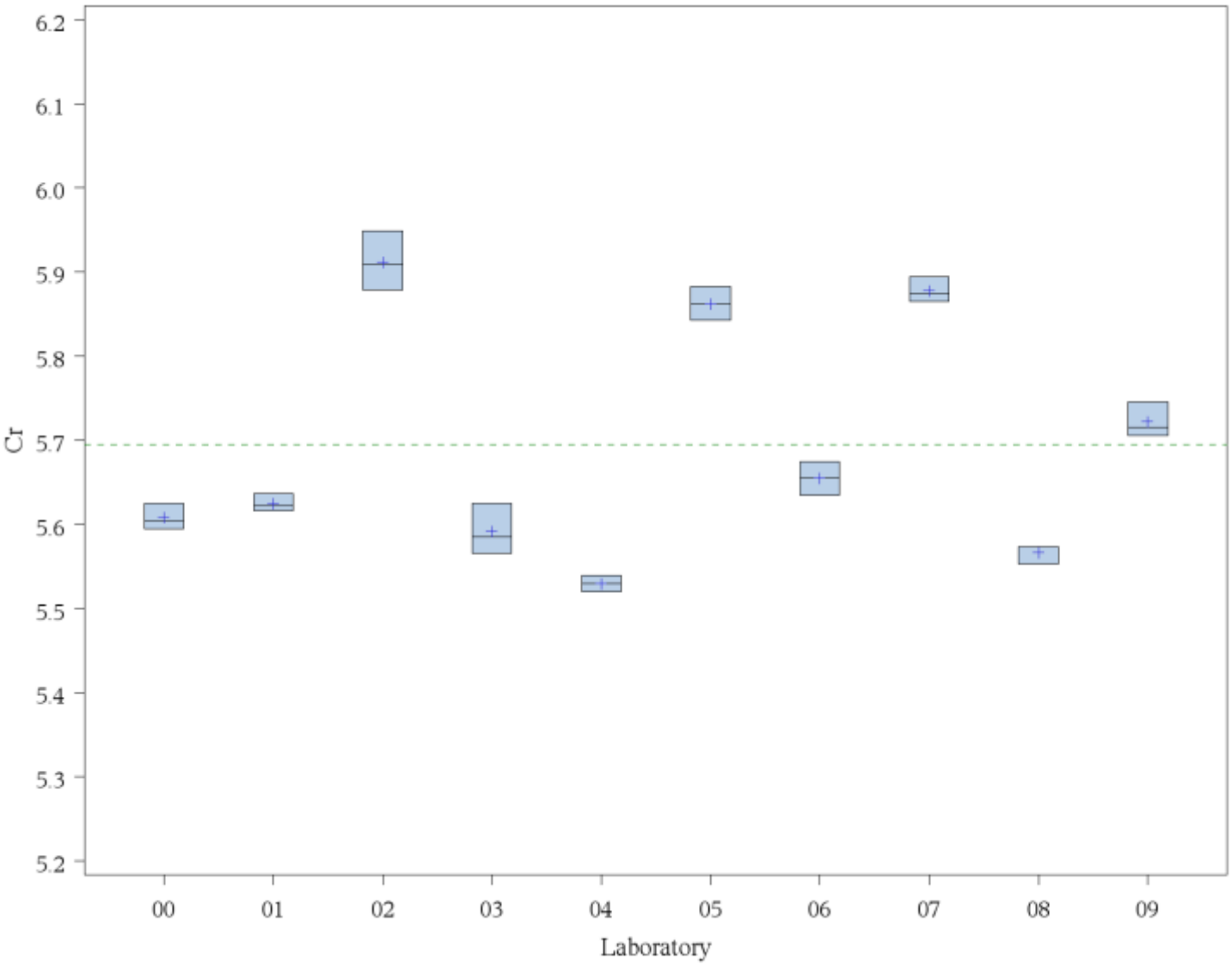
Variable	Cr
Variation_part_labo	97.90

11.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	-0.087	0.133	-0.348	0.174	NON
01	3	-0.070	0.133	-0.332	0.191	NON
02	3	0.217	0.133	-0.045	0.478	NON
03	3	-0.103	0.133	-0.364	0.158	NON
04	3	-0.165	0.133	-0.427	0.096	NON
05	3	0.167	0.133	-0.094	0.429	NON
06	3	-0.040	0.133	-0.302	0.221	NON
07	3	0.183	0.133	-0.078	0.444	NON
08	3	-0.128	0.133	-0.390	0.133	NON
09	3	0.027	0.133	-0.234	0.288	NON

11.8. Box-plot graphics

Box-plot graphics



12. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre K

12.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	7.114	0.017	0.244	0.035
01	3	7.075	0.010	0.146	0.021
02	3	7.308	0.000	0.000	0.000
03	3	6.886	0.012	0.169	0.023
04	3	6.833	0.055	0.807	0.110
05	3	7.442	0.015	0.206	0.031
06	3	7.007	0.006	0.083	0.012
07	3	7.402	0.015	0.206	0.030
08	3	7.007	0.049	0.703	0.099
09	3	7.226	0.006	0.080	0.012

12.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
7.094	7.133	4.303	7.070
7.063	7.086	4.303	7.049
7.308	7.308	4.303	7.308
6.873	6.899	4.303	6.857
6.771	6.896	4.303	6.696
7.425	7.460	4.303	7.404
7.000	7.013	4.303	6.992
7.385	7.419	4.303	7.364
6.951	7.062	4.303	6.884
7.220	7.233	4.303	7.212

Confidence_interval_T_up	Demi_amplitude_T
7.157	0.043
7.100	0.026
7.308	0.000
6.915	0.029
6.970	0.137
7.480	0.038
7.021	0.014
7.440	0.038
7.129	0.122
7.241	0.014

12.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	0.07	4.60
01	0.78	1.63
02	8.08	0.00
03	15.12	2.06
04	22.35	46.43
05	24.74	3.60
06	3.86	0.51
07	18.79	3.54
08	3.86	37.11
09	2.36	0.51

12.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	7.130
Repeatability_standard_deviat	0.026
Limit_of_repeatability	0.072
Repeatability_exp_uncertainty	0.051
Reproducibility_stand_deviat	0.210
Limit_of_reproducibility	0.589
Reproducibility_exp_uncertaint	0.421

12.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.72
Repro_exp_uncert_percent	5.90

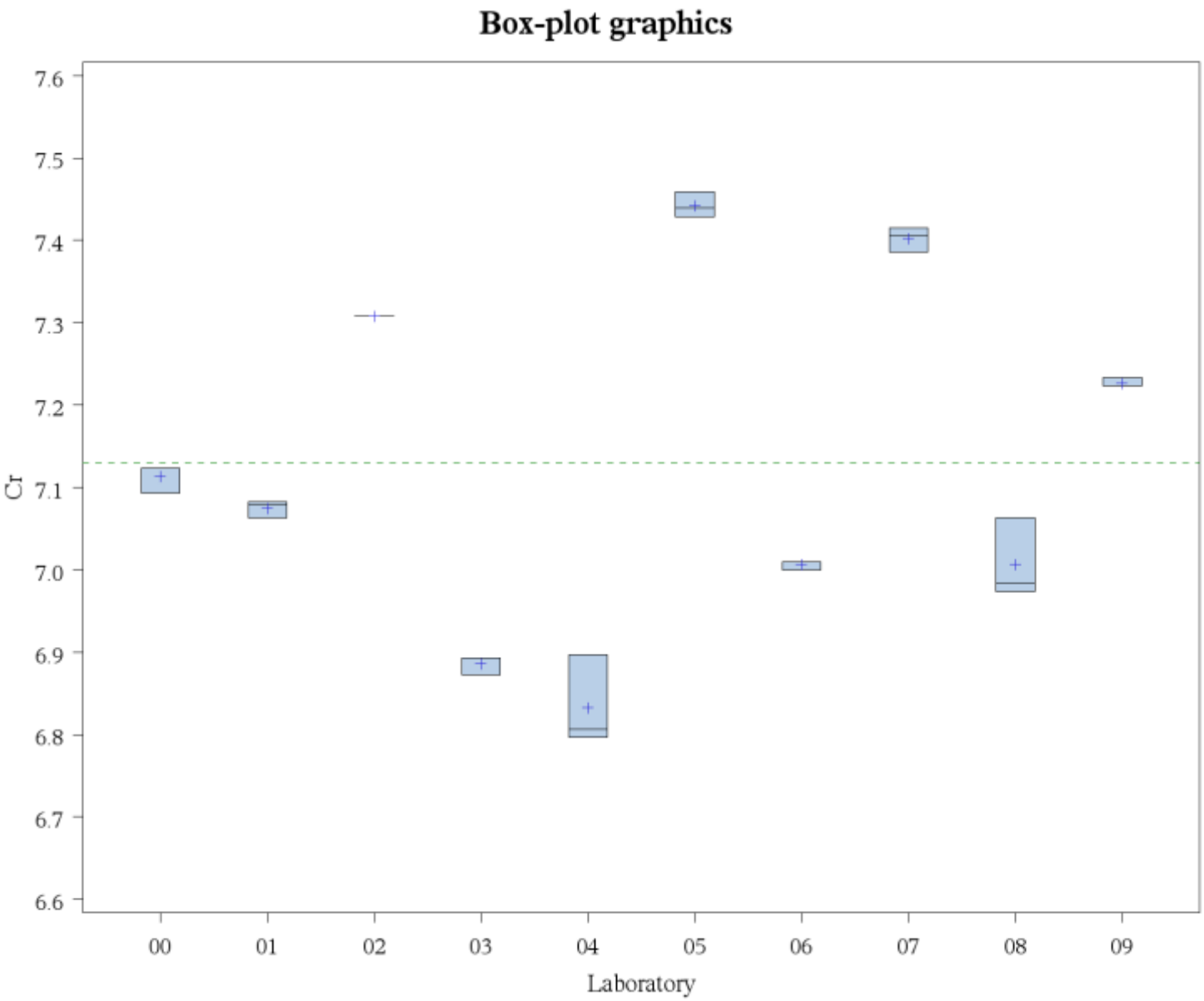
12.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.52

12.7. Trueness study - Estimation and significativity of the bias

Laboratory	nombre de valeurs non manquantes, Cr	Biais	Inc_biais	IC_inf_biais	IC_sup_biais	Biais_significatif
00	3	-0.016	0.199	-0.406	0.373	NON
01	3	-0.055	0.199	-0.444	0.334	NON
02	3	0.178	0.199	-0.211	0.568	NON
03	3	-0.244	0.199	-0.633	0.145	NON
04	3	-0.297	0.199	-0.686	0.092	NON
05	3	0.312	0.199	-0.077	0.701	NON
06	3	-0.123	0.199	-0.512	0.266	NON
07	3	0.272	0.199	-0.117	0.661	NON
08	3	-0.123	0.199	-0.512	0.266	NON
09	3	0.097	0.199	-0.293	0.486	NON

12.8. Box-plot graphics



Calculation of assigned values

1. Estimation of the variance of assigned values on corrected values for C1-C2 tyres

Batch	**Assigned value**	Repeatabiliy standard deviation	Reproducibility standard deviation	Variance Assigned values	**Standard deviation Assigned values**	Number of laboratories	Number of repetitions	**Inf**	**Sup**	Laboratory Variance
X	**5.421**	0.022	0.219	0.004	**0.066**	11	3	**5.289**	**5.553**	0.048
A	**6.083**	0.025	0.193	0.003	**0.058**	11	3	**5.967**	**6.198**	0.036
B	**6.588**	0.027	0.206	0.004	**0.062**	11	3	**6.464**	**6.711**	0.042
C	**7.612**	0.026	0.197	0.003	**0.059**	11	3	**7.494**	**7.730**	0.038
D	**8.526**	0.027	0.141	0.002	**0.042**	11	3	**8.442**	**8.610**	0.019
E	**10.063**	0.031	0.214	0.004	**0.064**	11	3	**9.935**	**10.191**	0.045

2. Estimation of the variance of assigned values on corrected values for C3 tyres

Batch	**Assigned value**	Repeatabiliy standard deviation	Reproducibility standard deviation	Variance Assigned values	**Standard deviation Assigned values**	Number of laboratories	Number of repetitions	**Inf**	**Sup**	Laboratory Variance
F	**3.623**	0.011	0.110	0.001	**0.035**	10	3	**3.554**	**3.692**	0.012
G	**4.501**	0.024	0.147	0.002	**0.046**	10	3	**4.409**	**4.593**	0.021
H	**5.358**	0.029	0.189	0.004	**0.059**	10	3	**5.240**	**5.477**	0.035
J	**5.695**	0.021	0.142	0.002	**0.044**	10	3	**5.606**	**5.784**	0.020
K	**7.130**	0.026	0.210	0.004	**0.066**	10	3	**6.998**	**7.262**	0.044

Regression functions

1. Regression functions for C1-C2 machines[5] - Cr (N/kN)

Lab.	Intercept $B1_l$	Standard error Intercept	Slope $A1_l$	Standard error Slope	s (Residual standard deviation)	R^2
Lab0	-0,1399	0,1300	0,9812	0,0166	0,1122	0,9952
Lab1	-0,1965	0,1363	1,0136	0,0179	0,1167	0,9948
Lab2	-0,4029	0,0792	1,0542	0,0105	0,0662	0,9983
Lab3	-0,0958	0,0834	1,0085	0,0110	0,0725	0,9980
Lab4	-0,2713	0,0512	1,0160	0,0067	0,0435	0,9993
Lab5	0,5070	0,0544	0,9674	0,0075	0,0512	0,9990
Lab6	0,2518	0,0760	0,9799	0,0102	0,0691	0,9982
Lab7	0,3390	0,0847	0,9727	0,0114	0,0779	0,9977
Lab8	0,1923	0,1299	0,9927	0,0175	0,1170	0,9947
Lab9	-0,2665	0,1051	1,0065	0,0135	0,0893	0,9969
Lab10	0,2320	0,0902	0,9848	0,0121	0,0818	0,9974

2. Regression functions for C3 machines – Cr (N/kN)

Lab.	Intercept $B1_l$	Standard error Intercept	Slope $A1_l$	Standard error Slope	s (Residual standard deviation)	R^2
Lab0	0,1554	0,1051	0,9890	0,0198	0,0913	0,9944
Lab1	0,0410	0,0726	1,0077	0,0137	0,0619	0,9974
Lab2	-0,2091	0,0564	1,0000	0,0101	0,0460	0,9986
Lab3	-0,0431	0,0576	1,0348	0,0110	0,0484	0,9984
Lab4	0,0053	0,0455	1,0388	0,0088	0,0386	0,9990
Lab5	0,1570	0,0384	0,9404	0,0069	0,0335	0,9992
Lab6	0,0197	0,0408	1,0098	0,0077	0,0347	0,9992
Lab7	-0,0528	0,0386	0,9719	0,0069	0,0324	0,9993
Lab8	-0,0474	0,0764	1,0213	0,0143	0,0641	0,9972
Lab9	0,0592	0,0777	0,9761	0,0142	0,0664	0,9970

[5] **$A1_l$ and $B1_l$ are the coefficients defined in annex IVa of Regulation (EU) N° 1222/2009**

Annex E - Template for candidate / reference laboratory alignment

1. General information of Applicant (Candidate laboratory)

Company: _____
Address: _____
City: _____ P.O. Box: _____
Contact person: _____ Position: _____
Telephone: _____ Fax: _____ E-mail: _____

a) Tyre manufacturer □ b) Independent laboratory □

Is your company integrated in a Group? □ Yes □ No
If yes, indicate which one: _____

Candidate machine identification
Trade Mark: _____ Serial number: _____
Test Lab location: _____ Year of make: _____
Date of last calibration: _____
The laboratory is certified/accredited/compliant to ISO 17025 □
The facility is certified / compliant to ISO /TS 16949 □
The laboratory complies with the specifications of ISO 28580 Annex A on test equipment tolerances □
Drum Ø [mm]: _____
Drum Surface: _____
Drum material: _____

Where to send the test tyres after testing:
Address: _____
City: _____ P.O.Box:_____
Contact person:_____

Test tyres provided:
Tyre type: □ C1/C2 □ C3
Method: □ Force □ Torque □ Power □ Deceleration

Test results of the n+1 measurements (corrected for drum diameter and room temperature)

Tyre : Make - Size – Designation	$RRC_{1,c}$ (kg/t)	$RRC_{2,c}$ (kg/t)	$RRC_{3,c}$ (kg/t)	$RRC_{4,c}$ (kg/t)	……	$RRC_{n+1,c}$ (kg/t)

Candidate machine measurement repeatability: σ_m (kg/t): _____

All the information included by the company in this form will be confidential.

2. General information of the Reference laboratory

Company: _____
Address: _____
City: _____ P.O. Box: _____
Contact person: _____ Position: _____
Telephone: _____ Fax: _____ E-mail: _____

a) Tyre manufacturer ☐ b) Independent laboratory ☐

Reference machine identification
Trade Mark: _____ Serial number: _____
Test Lab location: _____ Year of make: _____
Date of last calibration: _____
The laboratory is certified/accredited/compliant to ISO 17025 ☐
The facility is certified / compliant to ISO /TS 16949 ☐
The laboratory complies with the specifications of ISO 28580 Annex A on test equipment tolerances ☐
Drum Ø [mm]: _____
Drum Surface: _____
Drum material: _____

Test characteristics:
Method: ☐ Force ☐ Torque ☐ Power ☐ Deceleration

Test results, average of measurement 2 – 4, corrected for drum diameter and temperature:

Tyre : Make - Size – Designation	$RRC_{2,l}$(kg/t)	$RRC_{3,l}$(kg/t)	$RRC_{4,l}$(kg/t)	RRC avg. (kg/t)

3. Alignment equation

Regression formula[6]: **RRC = aligned value (kg/t)**
$RRC_{m,c}$ = candidate's measurement (kg/t)

$RRC = a * RRC_{m,c} + b$

a = _____ **b = _____**

$a = A1_l * A2_c$
$b = A1_l * B2_c + B1_l$
Coefficient of determination[7]: R^2 = _____
Date: _____
Stamp and Signature: _____

[6] **$A1_l$, $B1_l$, $A2_c$ and $B2_c$ are the coefficients defined in annex IVa of Regulation (EC) N° 1222/2009**
RRC is the assigned value of the rolling resistance coefficient aligned to EU Reference.
$RRC_{m,l}$ is the individual measured value of the rolling resistance coefficient by the reference laboratory (l) (including temperature and drum diameter corrections)
$RRC_{m,c}$ is the individual measured value of the rolling resistance coefficient by the candidate laboratory (c) (including temperature and drum diameter corrections)

[7] **Coefficient of determination R^2 is defined as the sum of squares due to the regression divided by the total sum of squares. Usually, R^2 is interpreted as representing the percentage of variation of the dependent variable explained by variation of the independent variables.**

Annex F - Guidance on how to handle the process of changing alignment equations, both for Reference and Candidate Laboratories

1. The applicable alignment equation is determined based on the measurement date:
   A Rolling Resistance test result generated ***before*** the date of entry into force of the new EGLA alignment equations (1 January 2022), will be aligned with the old equation and a test result generated ***after*** that date, will be aligned with the new equation.

2. If a Candidate Laboratory or another machine was aligned before this date, its current alignment equation is still valid for 2 years following its alignment report issue date.

3. If a validation check on a Label grade is done by a Testing Service or another Test Laboratory after this date, it can be done according to the following multi-steps approach:

(a) For a validation test result generated from (1 January 2022):

➔ Apply the alignment equation as from this report.

After this first step (a), if the results confirm the level of the Label grade, the tyre is declared compliant.
If the results do not confirm the level of the Label grade the second step (b) shall be applied.

(b) If the Label grade was originally based on an alignment report generated after 2nd December 2019, the tyre is declared non-compliant and the procedure defined in Annex V of Regulation (EC) N° 1222/2009 shall be applied

If the Label grade was originally based on an alignment report generated before December 2, 2019, the alignment equation applicable before 2nd December 2019 will be applied to these validation results.

After this second step (b), if these new results confirm the level of the Label grade, the tyre is declared compliant.
If these new results do not confirm the level of the Label grade, the tyre is declared non-compliant and the procedure defined in Annex V of Regulation (EC) N° 1222/2009 shall be applied.

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