Informal document No. **GRRF-71-10**
(71st GRRF, 13-15 September 2011
agenda item 6(d))

UNECE Regulation No 117

Testing method for measuring the wet grip index of C1 tyres
Proposed amendments

Ref ECE/TRANS/WP29GRRF/2011/12
Informal document GRRF-69-23

GRRF 71st session
Sep.13-15, 2011

Tyre Industry requests to amend R.117.02 by adopting the same test method for wet grip (C1 tyre category) as the one used for labeling purpose.

Background

When EC decided to introduce an EU regulation for tyre wet grip labelling, the tyre industry checked if the existing test method designed for Type Approval was suitable for that purpose.

The assessment made by tyre industry highlighted a too wide dispersion of the test results to comply with the requirements of labeling scheme (bandwidth of 15%).

Design of Experiment

- One Round Robin Test performed in three sessions at different temperature to cover the full range.
- Participation: 8 companies.
- Testing surfaces: 9
- Tyre sizes: 9 (5 Normal and 4 Snow tyres)
- Test method: vehicle and trailer.

More than 300 tests over more than 10 testing surfaces have been performed by the industry to verify the new testing conditions

UNECE R117 vs. R1222/2009 GRADING - WET GRIP TEST PROCEDURES

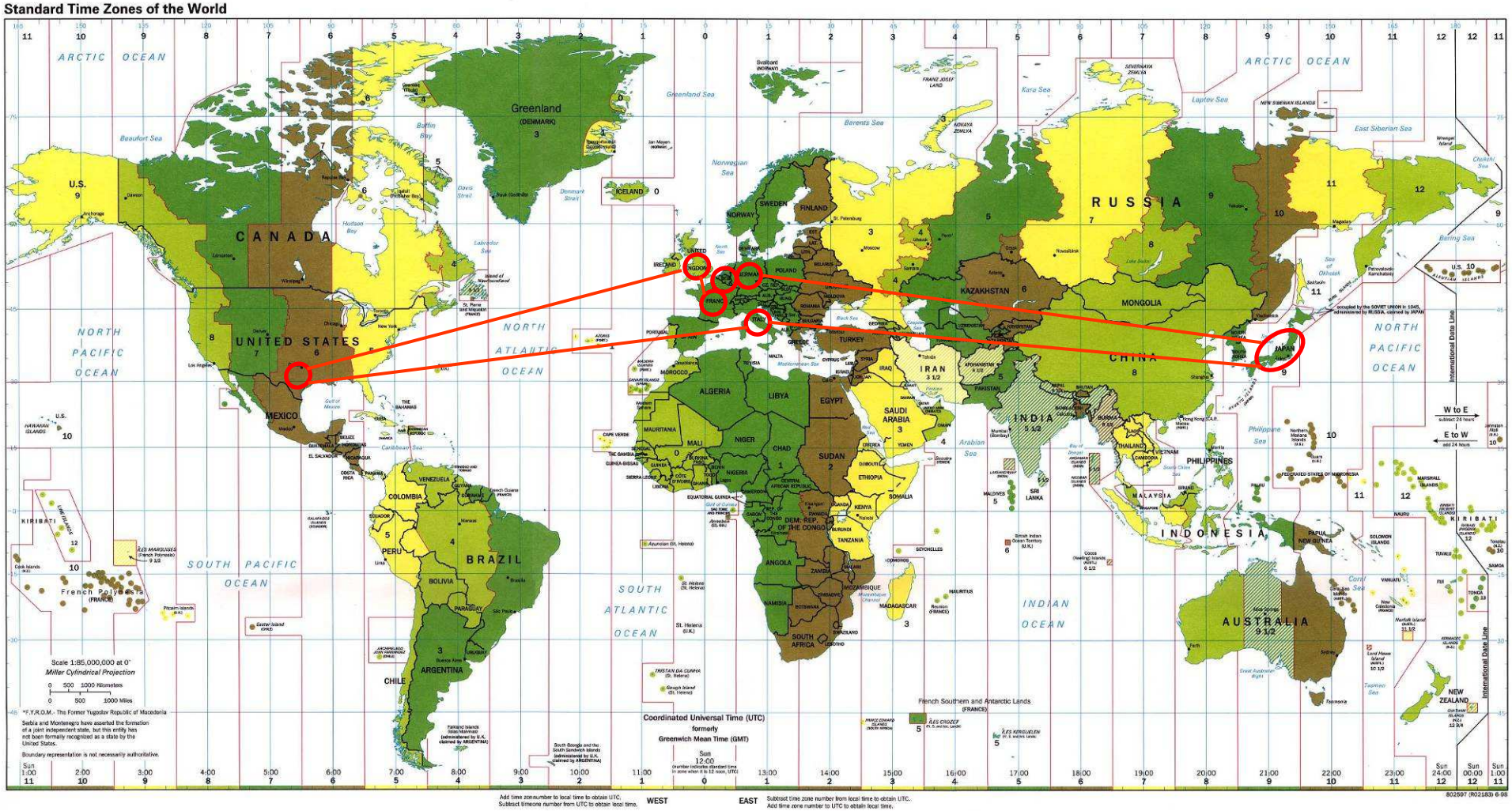
	ROUND ROBIN TESTS - NORMAL TYRES (YEAR 2008)				
TYRE SIZE	205/55 R 16	225/45 R 17	205/55 R 16	195/65 R 15	225/45 R17
BRAND NAME	BRIDGESTONE	CONTINENTAL	MICHELIN	VREDESTEIN	COOPER

SRTT TYRE SIZE	P195/75 R 14	P225/60 R16
ASTM	E 1136	F 2493 – 08

	ROUND ROBIN TESTS - SNOW TYRES (YEAR 2008)			
TYRE SIZE	205/55 R 16	205/55 R 16	205/55 R 16	205/55 R 16
BRAND NAME	CONTINENTAL	MICHELIN	GOODYEAR	BRIDGESTONE

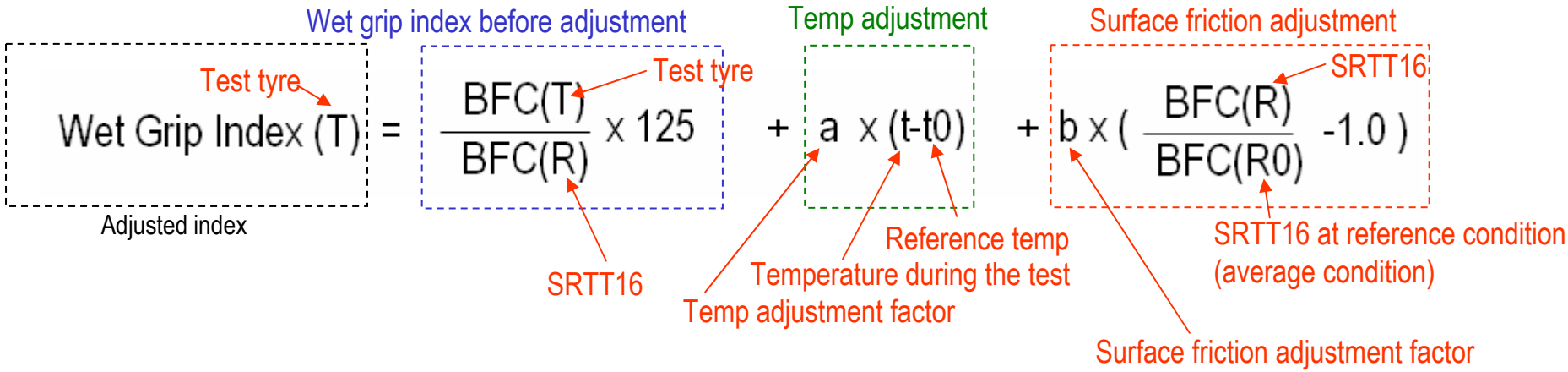
The selection of the test tyres sizes was according to the most representative tyres in their respective product segments.

Testing Tracks Location



Concept of the new test method

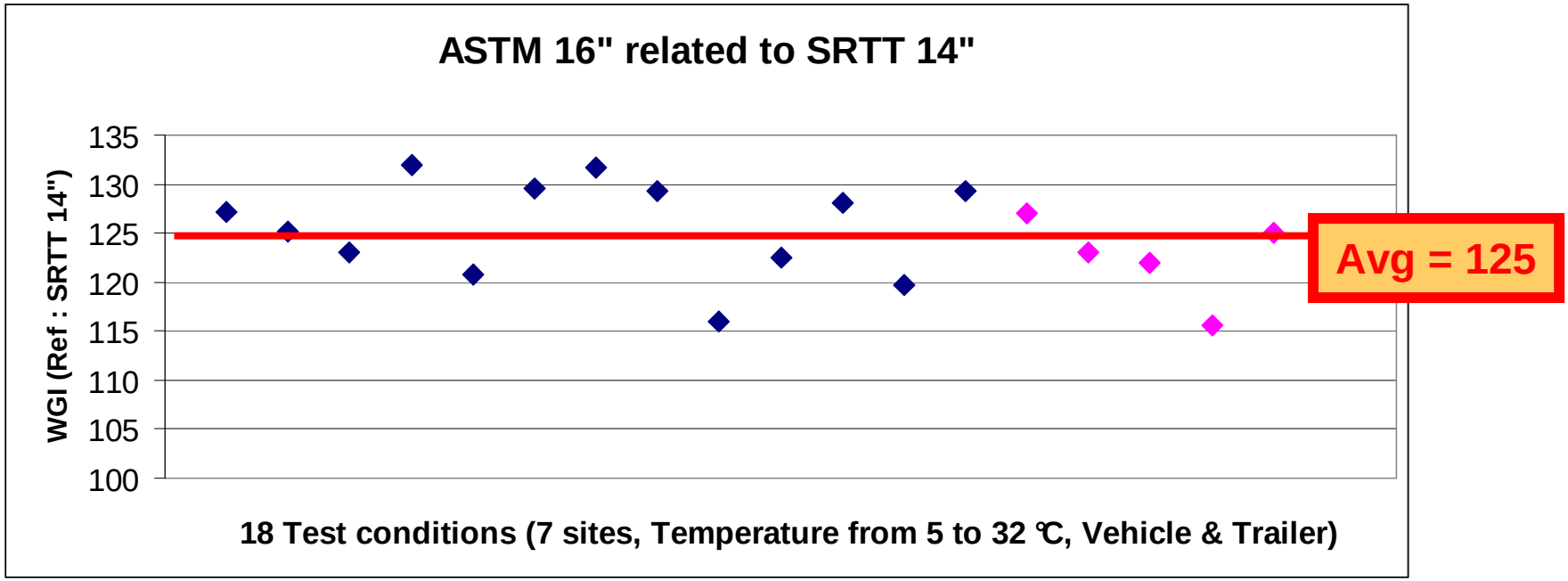
1. Use SRTT16 (Index of SRTT16 = 125)
2. Temperature adjustment and Surface Friction adjustment
3. Reference test conditions.



Explanations of the above three points are given in the following slides.

1. Use SRTT16 (Index of SRTT16 = 125)

- 2008 ETRTO Round Robin Test



$$\text{Wet Grip Index (T)} = \frac{\text{BFC(T)}}{\text{BFC(R)}} \times 125 + a \times (t - t0) + b \times \left(\frac{\text{BFC(R)}}{\text{BFC(R0)}} - 1.0 \right)$$

Wet grip index before adjustment

Temp adjustment

Surface friction adjustment

Test tyre

Test tyre

SRTT16

Adjusted index

SRTT16

Temperature during the test

Reference temp

SRTT16 at reference condition (average condition)

1. Use SRTT16 (Index of SRTT16 = 125)

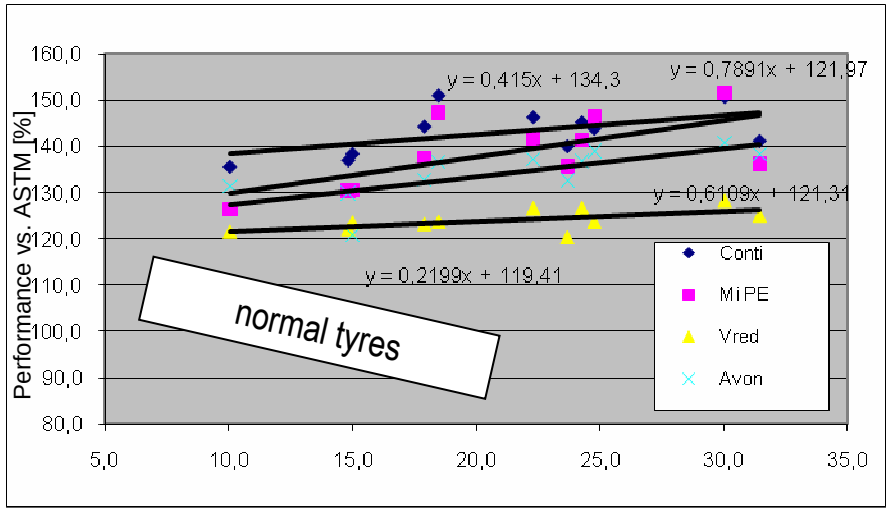
Uniroyal Tiger Paw
195/75 R 14
SRRT E1136

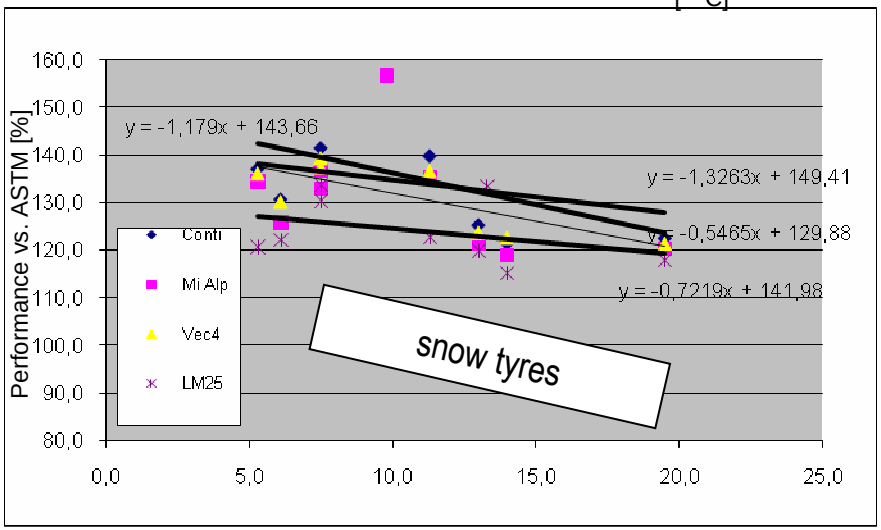
Uniroyal Tiger Paw
225/60 R 16
ASTM F2493'08

2. Temperature adjustment and Surface friction adjustment

- The test results variability of current wet grip test method in R117.02 is mainly due to the high diversity of the sensitivity behavior of the tyres to Track grip and Temperature parameters.
- These different sensitivities can be explained by the choice of proper tyre design criteria addressed to different conditions of use. That is the reason why, different treatments for snow and normal tyres are applied.
- For both normal and snow tyre the concept of temperature and friction ADJUSTMENT is introduced, (a and b coefficient) being representative of average variation of snow and summer categories.

2 a. Temperature adjustment and Surface friction adjustment

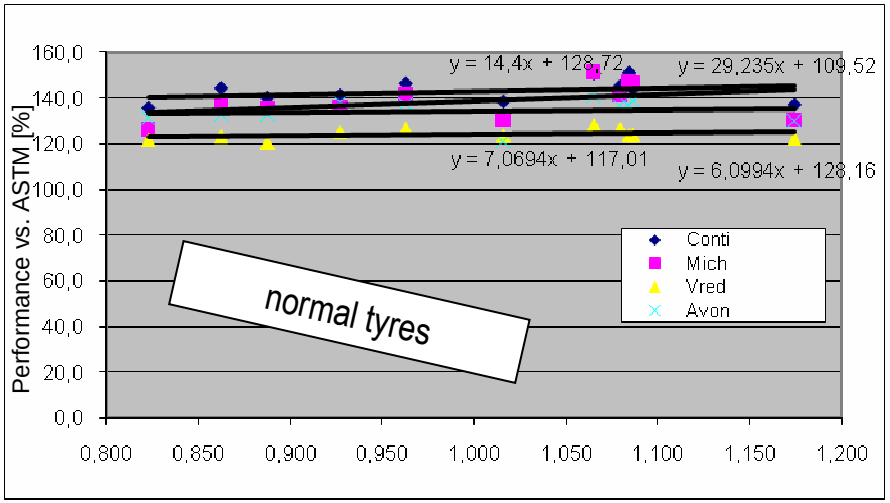




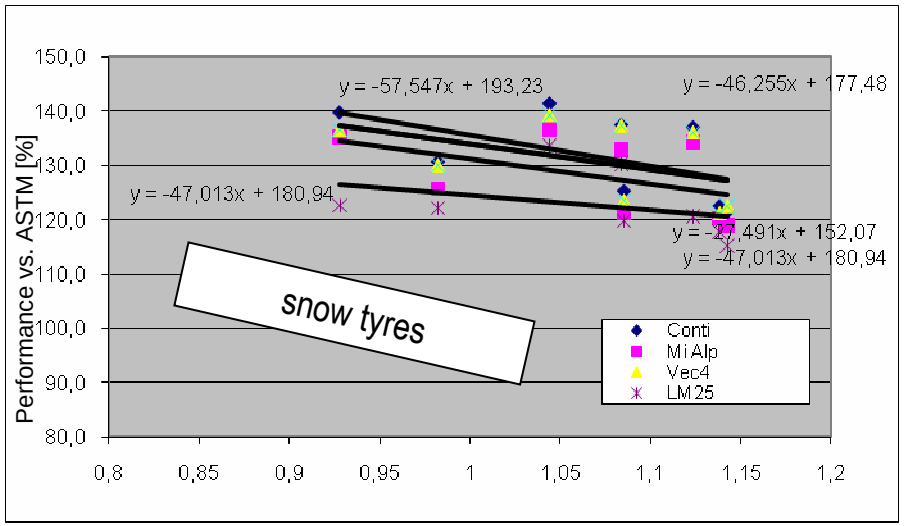
Temperature behavior of normal and snow tyres are different. Average slope of round robin tyres for both groups leading to adjustment factors a (see chart 6): -0,4232 (normal) and 0,7721 (snow)

For this reason the “a” factor is different for Normal and Snow tyres

2 b. Temperature adjustment and Surface friction adjustment



µ ASTM / 0,68 [ ]



µ ASTM / 0,68 [ ]

Surface friction behavior of normal and snow tyres are different. Average slope of round robin tyres for both groups leading to adjustment factors b (see chart 6): -8,297 (normal) and +31,18 (snow)

For this reason the “b” factor is different for Normal and Snow tyres

3. Reference test conditions

•Temperature normalization

20 ºC for Normal tyres as middle of the range 5- 35 ºC.

10 ºC for Snow tyres as middle of the range 2-20 ºC

Note: reference temperature of 20 ºC for snow tyre is not appropriate for service conditions and therefore the test temperature range had to be changed from 5- 35 ºC to 2-20 ºC.

• Surface normalization

0.70 which is the middle of the μ range 0.60- 0.80 (SRTT 14 μ) corresponding to BPN=51 which is the middle of the BPN range 42-60

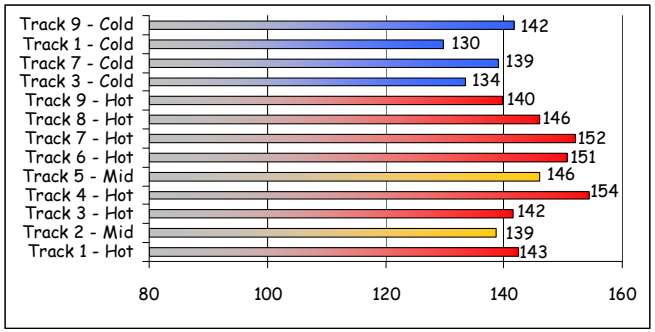
Test Results from the Round Robin Test 2008-2009

New test method allows to reduce significantly Standard Deviation

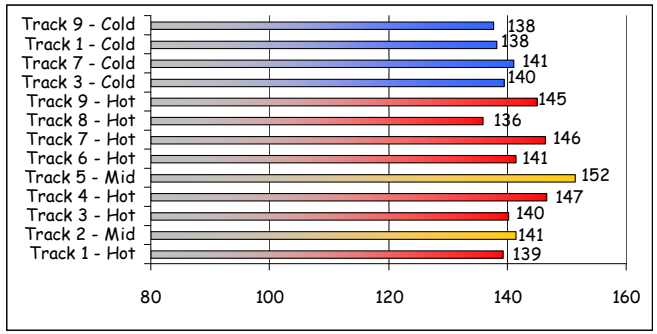
R117 test method application

New test method application

Normal tyre 1



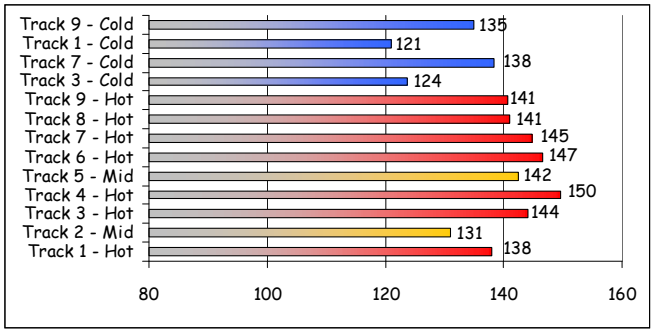
Avg / Std
143 / 7.1%



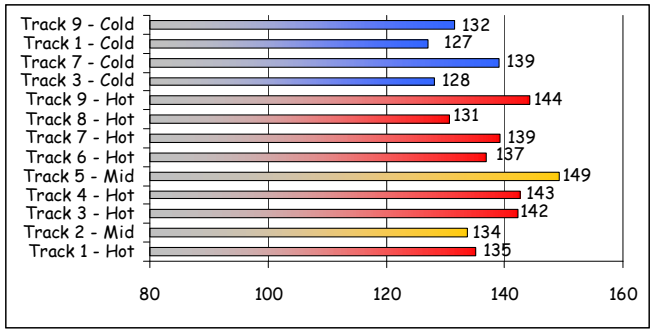
Avg / Std
142 / 4.3%

-2.8%
40%

Normal tyre 2



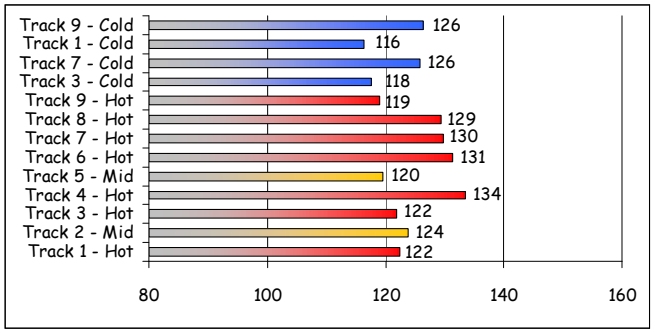
Avg / Std
138 / 8.6%



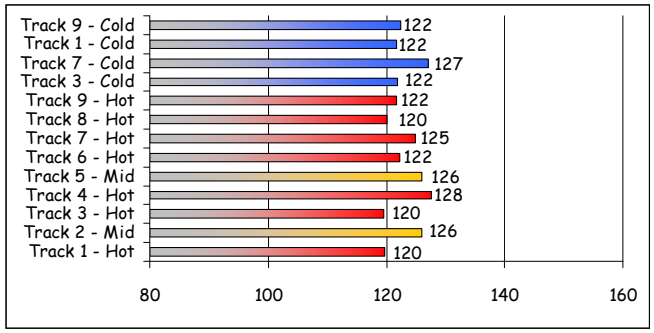
Avg / Std
137 / 6.7%

-1.9%
22%

Normal tyre 3



Avg / Std
124 / 5.5%



Avg / Std
123 / 2.8%

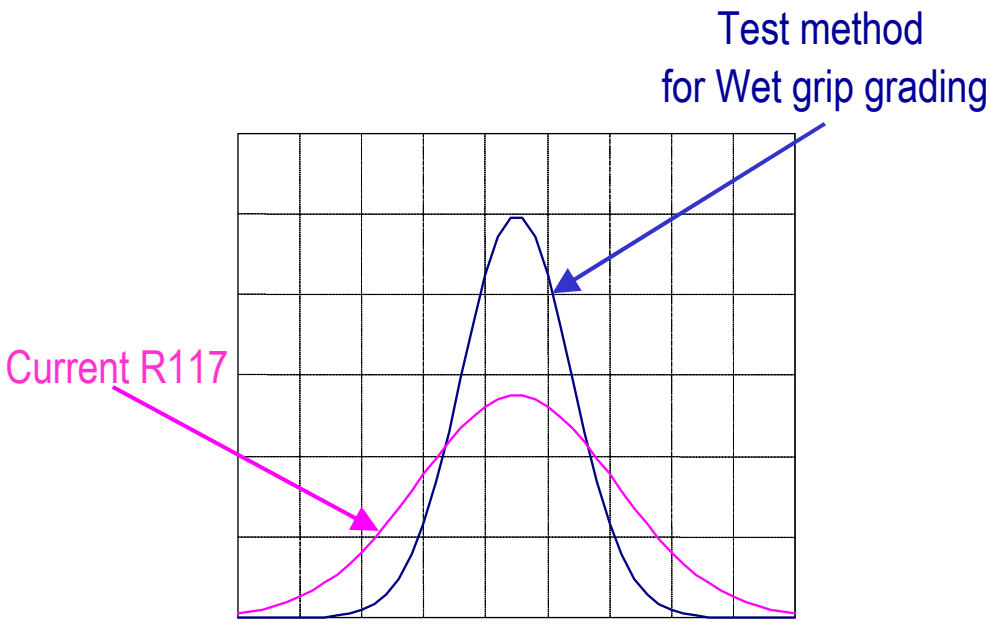
-2.7%
50%

Test Results from the Round Robin Test 2008-2009

R117 test method application

New test method application

	R117 test method application	New test method application	
Normal tyre1	Std 7.1%	Std 4.3%	-2.8% 40%
Normal tyre2	Std 8.6%	Std 6.7%	-1.9% 22%
Normal tyre3	Std 5.5%	Std 2.8%	-2.7% 50%



Tested on 9 different tracks
Temperature range from cold to hot

New test method allows to reduce significantly Standard Deviation

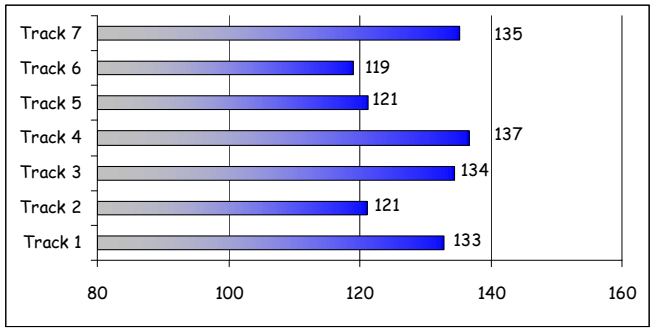
Test Results from the Round Robin Test 2008-2009

New test method allows to reduce significantly Standard Deviation

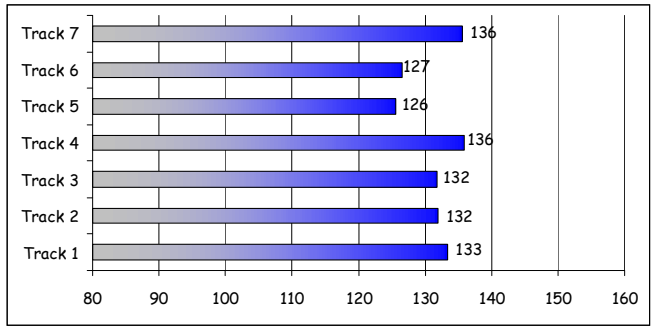
R117 test method application

New test method application

Snow tyre 1



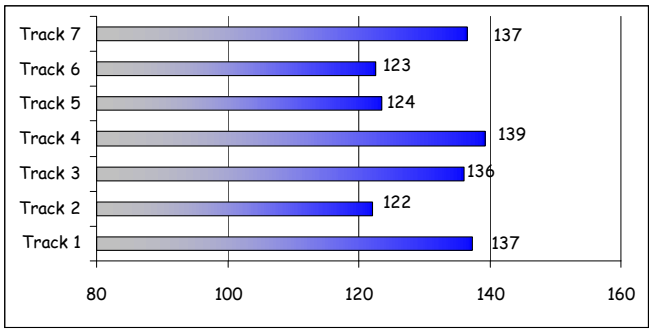
Avg / Std
132 / 11.9%



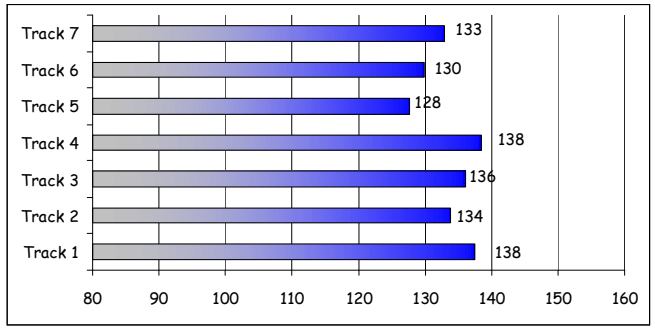
Avg / Std
134 / 6.8%

-5.1%
43%

Snow tyre 2



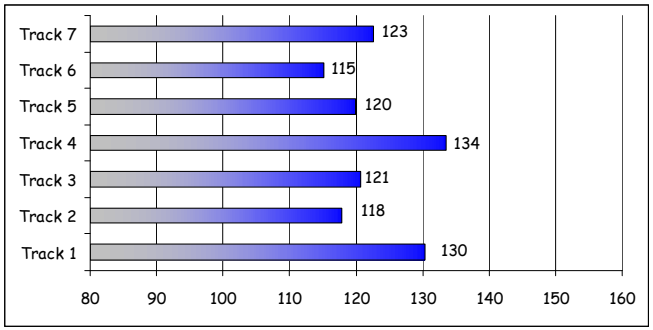
Avg / Std
135 / 13.1%



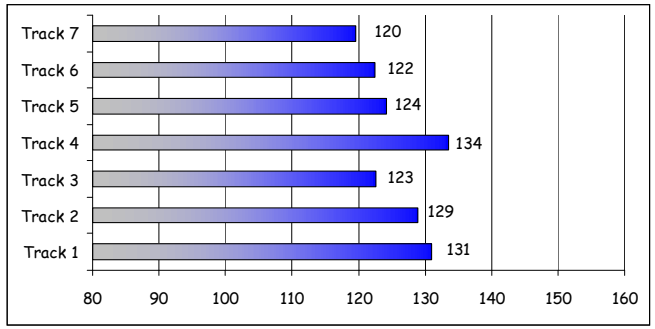
Avg / Std
137 / 8.6%

-4.5%
34%

Snow tyre 3



Avg / Std
124 / 7.3%



Avg / Std
127 / 4.9%

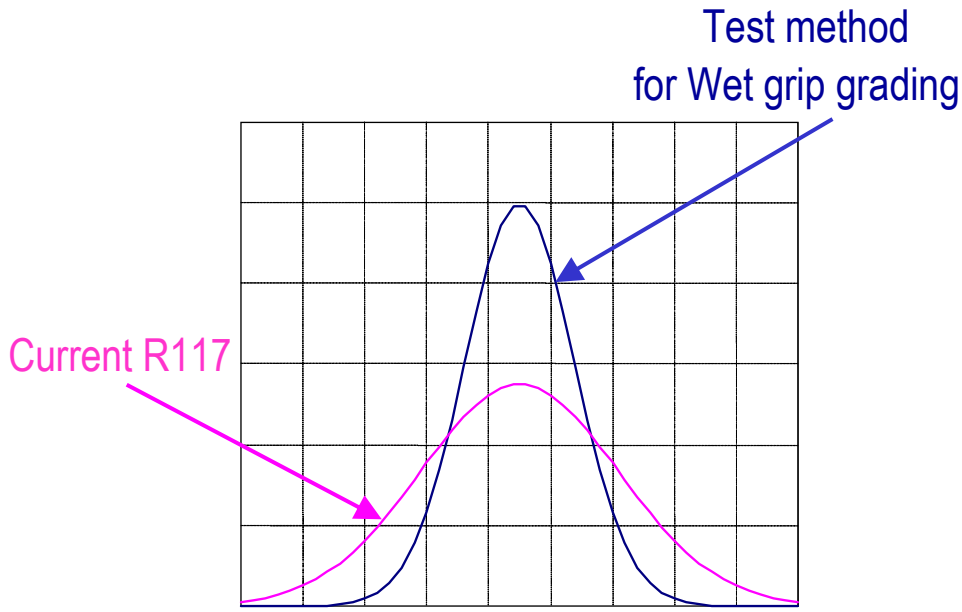
-2.4%
33%

Test Results from the Round Robin Test 2008-2009

R117 test method application

New test method application

	R117 Std	New test method Std	
Snow tyre 1	11.9%	6.8%	-5.1% / 43%
Snow tyre 2	13.1%	8.6%	-4.5% / 34%
Snow tyre 3	7.3%	4.9%	-2.4% / 33%



Tested on 9 different tracks
Temperature range from cold to hot

New test method allows to reduce significantly Standard Deviation

Summary

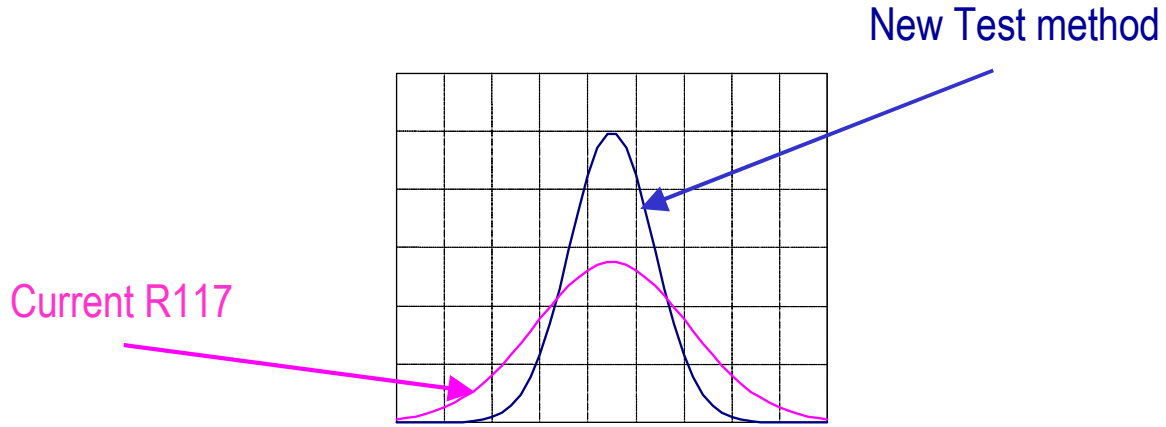
		Normal tyres	Snow tyres
Improvement Action	Current Reg117	Test Method for WetGrip Grading	Test Method for WetGrip Grading
Quality Target	Item not covered	Weighted standard deviation<=5%	Weighted standard deviation<=5%
Reference Tire	SRTT14	ASTM 16=125%	ASTM 16=125%
Differentiate Normal/Snow grading scheme	not mentioned	No	No
Differentiate Normal/Snow testing conditions	not mentioned	Yes	Yes
Wet surface Temperature Range	5-35 ℃	5-35 ℃	2-20 ℃
Ambient Temperature Range	not mentioned	5-35 ℃ close to water temp (10℃ max. difference)	2-20℃ close to water temp (10℃ max. difference)
BPN Range	40-60	as Reg117 for skid trailer mu (0.6-0.8) corresponding BPN range 42-60	as Reg117 for skid trailer mu (0.6-0.8) BPN range 42-60
Correction Factor introduction for Wet Grip Index (Friction and Temperature)	not mentioned	Yes Both different between normal & snow tyres	Yes Both different between normal & snow tyres
Reference conditions	not mentioned	for vehicle (20℃, 0.68 mfdd) for trailer (20℃, 0.85 pbfc)	for vehicle (10℃, 0.68 mfdd) for trailer (10℃, 0.85 pbfc)
Pros (by column)	reliable for homologation	the method is valid for both normal & snow tyres	the method is valid for both normal & snow tyres

BPN= British pendulum Number mfdd= mean fully developed deceleration pbfc= peack braking force coefficient

Conclusion

Advantages of a single wet grip test method (C1 tyre category):

- **Reduces the test results dispersion.**



- **Introduces an SRTT Rim code 16 that fits better on the current vehicle mountings (size much closer to current tyre sizes). This reduces the need to use an intermediate control tyre.**
- **Cost saving: CoP test results can be used for market surveillance in the frame of tyre labelling.**
- **Cost reduction for Tyre Industry due to adoption of a single test method.**

1/17

Annex

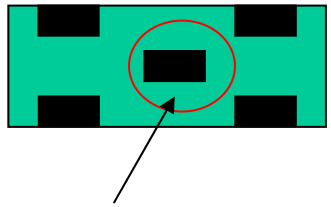
Basic concept of R117 and new Test method

80km/h → 20km/h Deceleration G

Water film 0.5-1.5mm

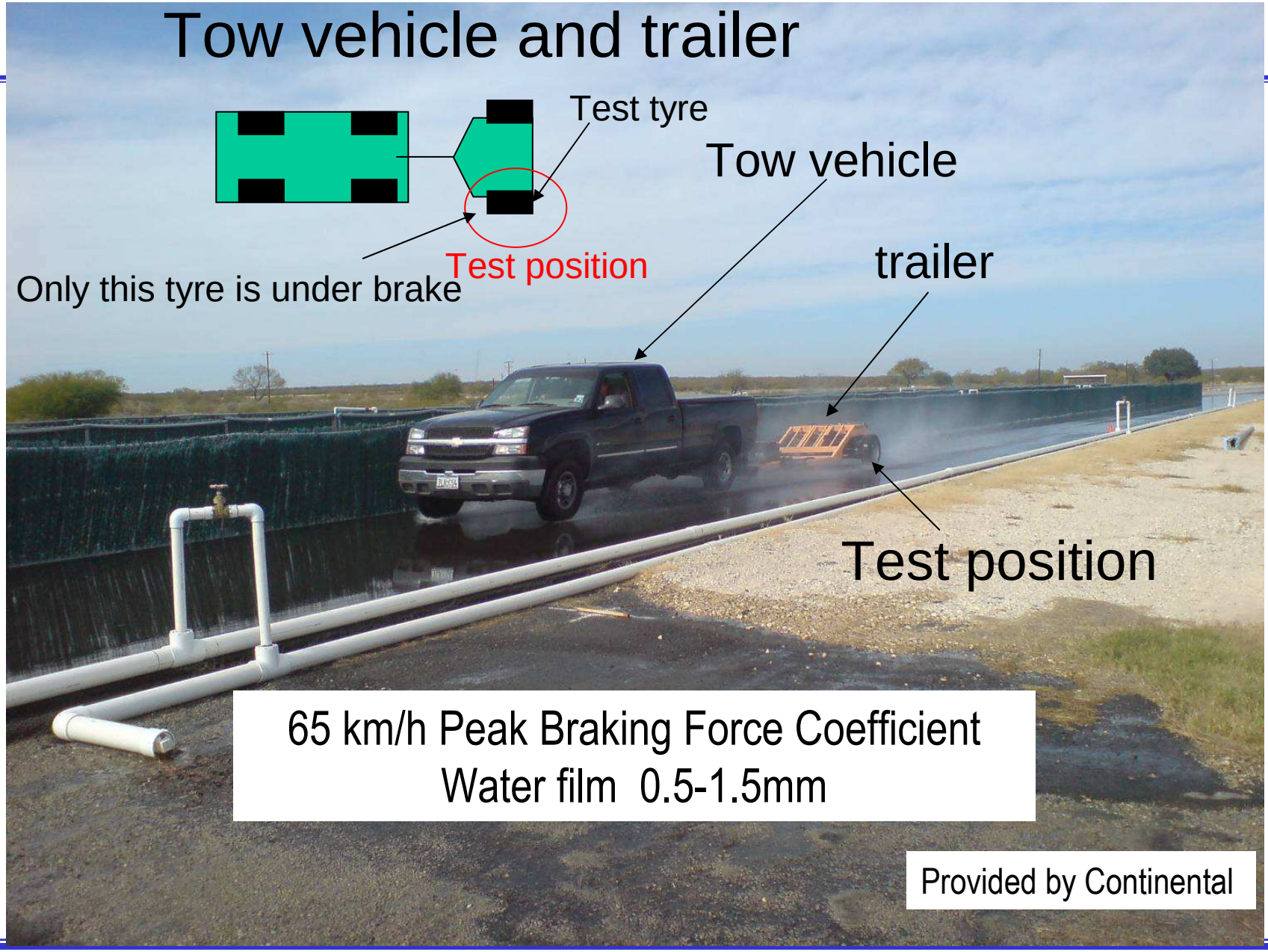
Modified truck (on the center of floor, we can add additional tyre axle which the test tyre will be attached.)

tyre test vehicle



65 km/h Peak Braking Force Coefficient
Water film 0.5-1.5mm

Tow vehicle and trailer



65 km/h Peak Braking Force Coefficient
Water film 0.5-1.5mm

Provided by Continental

BPN measurement

End