



Informal document GRBP-71-06
Agenda item 5 (d)

Standard Reference Test Tyre replacement

GRBP session 71, January 2020



Replacement SRTT

- 1. Background**
- 2. Current Situation**
- 3. Activities from ASTM F1805 snow spin traction test**
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Replacement SRTT

1. Background

- **C1- SRTT14 (ASTM E1136) will be phased out:**
 - Production will stop mid of 2020
 - Sales end is approximately end of 2021
- **Snow performance test in R117 currently requires SRTT14 as a reference tyre**

→ SRTT14 needs to be replaced and test procedure amended

- **SRTT16 (ASTM F2493) is already available and used for Wet Grip test in R117**
- **Approach is to establish a calculation factor to correlate results vs SRTT16 with those vs SRTT14 and keep current thresholds:**

$$Tire1\ Rating = \frac{Tire1\ Coef.}{14''\ Coef.} = \frac{Tire1\ Coef.}{16''\ Coef.} \times \frac{16''\ Coef.}{14''\ Coef.}$$

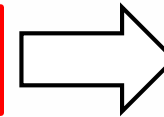
(Therefore, the equivalent 14" rating can be estimated using only the 16" SRTT rating and the prediction of the 16"/14" ratio)

Need to predict this value, because the 14" SRTT will not be available long term

2. Current Situation - Specifications according to UN R117

6.4. In order to be classified as a "snow tyre for use in severe snow conditions" the tyre shall meet the performance requirements of paragraph 6.4.1. below. The tyre shall meet these requirements based on a test method of Annex 7 by which:

- (a) The mean fully developed deceleration ("mfdd") in a braking test,
- (b) Or alternatively an average traction force in a traction test,
- (c) Or alternatively the average acceleration in an acceleration test



- (a) **C1 Braking test**
- (b) **C1/C2 Spin traction test**

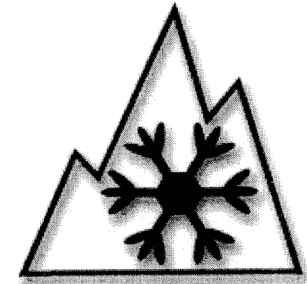
of the candidate tyre is compared to that of a standard reference tyre.

The relative performance shall be indicated by a snow index.

6.4.1. Tyre snow performance requirements

6.4.1.1. Class C1, C2 and C3 tyres

The minimum snow index value, as calculated in the procedure described in Annex 7 and compared with the SRTT shall be as follows:



<i>Class of tyre</i>	<i>Snow grip index (brake on snow method) ^(a)</i>		<i>Snow grip index (spin traction method) ^(b)</i>	<i>Snow grip index (acceleration method) ^(c)</i>
	<i>Ref. = SRTT14</i>	<i>Ref. = SRTT16C</i>	<i>Ref. = SRTT14</i>	<i>Ref.s = SRTT19.5, SRTT22.5</i>
C1	1.07	No	1.10	No
C2	No	1.02	1.10	No
C3	No	No	No	1.25



2. Current Situation - Specifications according to UN R117

Braking on Snow Method for C1 :

Vehicle:	market available vehicles
Reference Tyre:	SRTT14 (P195/75 R 14 Tiger Paw)
Tyre Configuration:	all axle positions
Tyre Condition:	broken-in
Snow surface:	packed snow with CTI 75 – 85
Ambient Temperature:	-2°C to -15°C
Surface Temperature:	-4°C to -15°C
Initial Speed:	higher than 28 km/h
Braking down to	min. 8 km/h or less
Recorded Measure:	Average deceleration from 25 down to 10 km/h



Replacement SRTT

3. Activities of ASTM for spin traction test method

ASTM is going to replace SRTT14 by SRTT16 by establishing a correlation factor for medium packed snow

- Considered SRTT16 μ coefficient of 0,23-0,38 an
- the calculation of the average SRTT16 / SRTT14 ratio yields a value 0,987 as shown in the below section from [ASTM report on E1136 to F2493 SRTT Transition for ASTM F1805](#)

Results

- Table A2.1 revised in ASTM F1805-18 to update some min/max Tractive Coefficients versus SRTT14 and add Tractive Coefficients versus SRTT16 for each surface type.

Surface Type	E1136 (SRTT14) Min, Max	F2493 (SRTT16) Min, Max
Soft pack (new) snow	0.18, 0.22	0.17, 0.21
Medium pack snow	0.25, 0.38	0.23, 0.38
Medium hard pack snow	0.25, 0.36	0.25, 0.38
Hard pack snow	0.15, 0.20	0.15, 0.23
Ice – wet	0.06, 0.12	0.06, 0.13
Ice - dry	0.06, 0.14	0.08, 0.13

- Two Correlation Factor options developed based on a Linear Model approach and a Constant Ratio approach.
- Consensus of ASTM F09 Committee on Tires is to move forward with the Constant Ratio approach.
 - Equivalent SRTT14 Rating = Measured SRTT16 Rating x SRTT16 Correlation Factor (where SRTT16 Correlation Factor = 0.987)

Summary

- The F2493 SRTT (SRTT16) is an acceptable replacement for the E1136 SRTT (SRTT14) as a reference tire for ASTM F1805 winter traction testing.
- The necessary tools are now in place to transition ASTM F1805 testing away from SRTT14 as it is phased out of production in late 2019 or 2020.



Replacement SRTT

4. ETRTO activities for R117 snow braking test

Test Program with ETRTO Members (SRTT14 replacement by SRTT16)

(Direct comparison: Reference set is the ASTM SRTT (P195/75 R 14 92S = 100%))

- Temperature variation: 4 temperature segments are used from -2°C down to < -21°C

R117 range

Agreed for RRT	Segment 1	Segment 2	Segment 3	Segment 4
ambient temperature	-2°C -7°C	< -7°C -15°C	< -15°C ... -21°C	< -21°C
snow temperature	-4°C -9°C	< -9°C -15°C	< -15°C ... -21°C	< -21°C

- Snow compaction (CTI) variations: results are generated in a range from CTI 73 to 88
 - in order to cover the legal R117 range (75 to 85 CTI)
 - and to generate sufficient overlap with the ASTM F1805 test method
 - medium packed snow → CTI 70 .. 80
 - medium hard packed snow → CTI 80 .. 84
 - Hard packed snow → CTI 84 .. 93
- Indoor / Outdoor (land/lake) test location are used
- 8 different tire companies produced 55 test results with 38 results within the allowed range of testing conditions for temperature and snow compaction of R117. Temperature range was extended to ensure the stability of the correlation.



SRTT16/SRTT14 ratio		
	All Data points	Data points in Legal Temp range
Mean	0.980	0.980
Std Dev	0.034	0.037
Upper 95% Mean	0.989	0.992
Lower 95% Mean	0.971	0.968
N	55	38
Minimum	0.919	0.919
Maximum	1.060	1.060



6. Conclusions

After deep analysis of all available data and taking into consideration the statistical analyses, the following agreed conclusions can be stated:

- a. Average snow performance (SGI) of SRTT16 is 0.98 for snow braking method
(vs. SRTT14, excl. outliers)

 - b. This result is very close to the ASTM spin traction study → factor = 0,987
- Calculation factor method is also possible for snow braking test so that existing threshold (107% vs. SRTT14) can be kept.



7. Recommendations

- Use for both test methods (snow braking and spin traction) the calculated corresponding correlation factors (SRTT14 – SRTT16) in order to keep both thresholds (spin traction snow: 110%; snow braking: 107%) untouched!
- That means to **introduce a calculation formula for snow braking test** with a similar correlation factor than ASTM spin traction test:

$$SGI_{(14)} = SGI_{(16)} \times 0,980$$

$SGI_{(14)}$ = snow grip index of candidate vs. SRTT14 (calculation reference)

$SGI_{(16)}$ = snow grip index of candidate vs. SRTT16 (test reference)

0,980 = correlation factor for change to SRTT16

- Transition provision proposal:
 - Adequate transitional provisions need to be considered
 - It is recommended to use the SRTT14 not longer than until September 2024
 - During this period both SRTTs can be used for performing snow performance tests (in case of using SRTT14: w/o calculation formula)
- **A working document will be presented at the next GRBP session in September 2020**



Appendix



Motivation for Replacement SRTT14

- C1- SRTT14 will be phased out:
 - Michelin will stop production mid of 2020
 - Sales end is appr. end of 2021
 - replacement is needed

- Feasibility of using (C1) SRTT16 (P225/60R16 Tiger Paw) as replacement of (C1) SRTT14
 - Worldwide availability is given
 - SRTT16 already in use for R117 wet grip testing

- Creating data base for assessment (and further correlation with ASTM results)
 - Conduction snow braking tests under different conditions
 - Developing a robust correlation formula/factor for future use

Replacement SRTT

Result Analysis – Overview Test Results



Main test Data				Test Conditions						SRTT 14 (195/75 R 14)		SRTT 16 (225/60 R 16)		
Test No.	Test Company	Test Track Land / lake / indoor	Test Vehicle	tire load front [Kg]	tire load rear [Kg]	Temp. Segment (1,2,3,4)	Ambient Temperature [°C]	Snow Temperature [°C]	Average CTI (75..85)	Average Deceleration of SRTT [m/s ²]	offset* (ref. trend) [%]	average deceleration [m/s ²]	Variation Coefficient (%)	SGI [%]
3	A	Land	TOYOTA, Noah, 2015	942	901	2	-8,3	-7,7	80	-3,05	-0,76	-2,84	0,75	93,0
4	A	Land	TOYOTA, Noah, 2015	942	901	2	-5,2	-4,1	82	-2,98	-2,56	-2,74	0,94	92,0
5	B	Land	VW Caddy	880	900	1	-2	-4	83	2,99	3,5	2,87	1,3	96,0
6	B	Land	VW Caddy	880	900	1	-2	-4	83	2,98	1,7	2,89	2	97,0
8	B	Land	VW Caddy	880	900	2	-14	-13	85	2,71	1,9	2,61	2	96,0
9	C	Indoor	VW Golf 1.4TSI, 2018, manual	888	902	2	-8,3	-7,6	84	2,935	1,72	2,85	3,48	97,3
10	C	Indoor	VW Golf 1.4TSI, 2018, manual	888	902	2	-8,9	-7,8	84	2,9	-4,05	2,86	4,06	97,9
11	C	Land	VW Golf 1.4TSI, 2018, manual	888	902	1	-5	-4	82	3,02	0,33	2,78	3,36	91,9
12	C	Land	VW Golf 1.4TSI, 2018, manual	920	895	2	-11	-11	77	2,9	-2,05	2,68	4,27	92,7
13	C	Land	VW Golf 1.4TSI, 2018, manual	920	895	2	-10	-13	81	3,07	2,64	2,88	3,68	93,2
16	D	Land	VW Golf 4 1.4, 2003, manual	not reported	not reported	2	-11	-10	84	3,53	-4,10	3,5	-3,8	99,5
17	D	Land	VW Golf 4 1.4, 2003, manual	not reported	not reported	2	-11	-10	84	3,46	-1,30	3,3	-1,2	94,1
18	D	Land	VW Golf 4 1.4, 2003, manual	not reported	not reported	2	-11	-10	85	3,62	-1,20	3,5	-1,1	96,8
19	D	Land	VW Golf 4 1.4, 2003, manual	not reported	not reported	2	-11	-10	85	3,20	-2,50	3,2	-3,8	100,0
20	E	Lake	Skoda Yeti	920	920	2	-15	-15	85	-3,29	0,90	-3,6	2,2	102,3
21	E	Lake	Skoda Yeti	920	920	2	-9	-9	85	-3,16	1,30	-3,4	1,8	107,6
23	E	Lake	Skoda Yeti	920	920	1	-8	-5	83	-2,43	2,00	-2,4	1,4	97,7
24	F	Land	VW Golf	929	949	2	-5	-14	85	-3,11	0,01	-3,1	0,8	99,0
25	F	Land	VW Golf	937	936	2	-5	-12	85	-3,21	2,56	-3,2	1,3	100,0
26	F	Land	VW Golf	888	911	2	-10	-11	85	-3,23	0,39	-3,2	1,2	100,0
1	G	Land	Golf VI - 2.0L tdi 140CV	883	903	2	-10	-12	75	2,83	0,09	2,6	5,5	92,3
2	G	Land	Golf VI - 2.0L tdi 140CV	883	903	1	-3	-6	78	3,38	2,73	3,3	2,9	97,1
6	G	Land	Golf VI - 2.0L tdi 140CV	883	903	2	-10	-11	75	3,34	2,93	3,3	3,3	98,9
7	G	Land	Golf VI - 2.0L tdi 140CV	883	903	1	-6	-8	84	2,87	1,27	2,6	3,6	92,0
9	G	Land	Golf VI - 2.0L tdi 140CV	883	903	1	-7	-8	84	3,46	0,77	3,3	2,5	96,2
11	G	Land	Golf VI - 2.0L tdi 140CV	883	903	1	-2	-5	78	3,49	2,38	3,5	1,5	99,4
13	G	Land	Golf VI - 2.0L tdi 140CV	883	903	1	-6	-8	87	2,91	3,55	2,89	4,6	99,3
14	G	Land	Golf VI - 2.0L tdi 140CV	883	903	1	-5	-7	86	3,28	3,50	3,20	3,2	97,4
15	G	Land	Golf VI - 2.0L tdi 140CV	883	903	2	-15	-11	86	3,43	0,41	3,37	2,5	98,1
27	H	Land	VW Golf VII 1.4 TSI	885	909	1	-5,6	-4	82	-3,59	3,80	-3,76	3,1	104,7
33	H	Land	VW Golf VII 1.4 TSI	885	909	2	-12,9	-12,5	84	-3,36	0,50	-3,37	3,2	100,4
37	H	Land	VW Golf VII 1.4 TSI	885	909	1	-5,5	-6,4	82	-3,07	0,10	-3,03	1,9	98,7
39	H	Land	VW Golf VII 1.4 TSI	885	909	2	-11	-12	83	-3,15	-0,90	-3,18	1,6	101,2
40	H	Land	VW Golf VII 1.4 TSI	885	909	1	-5,9	-4,5	84	-3,08	-3,50	-3,20	2,0	104,2
1	I	Land	VW GOLF VII 1.5 TSI	940	940	1	-2,1	-4	84	3,28	2,10	3,23	1,7	98,0
4	I	Land	VW GOLF VII 1.5 TSI	940	940	1	-3,25	-8	87	3,61	2,40	3,62	2,1	100,0
5	I	Land	VW GOLF VII 1.5 TSI	940	940	1	-2	-5,4	78	3,82	2,90	4,00	1,7	105,0
6	I	Land	VW GOLF VII 1.5 TSI	940	940	1	-2	-5,4	84	3,80	1,00	3,79	1,8	100,0
7	I	Land	VW GOLF VII 1.5 TSI	940	940	2	-7,4	-10,5	86	3,17	2,90	3,36	2,4	106,0



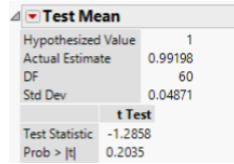
Replacement SRTT

Result Analysis – Deeper Statistical Analysis

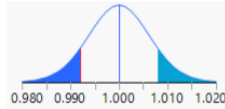
- Temperature Range:
 - 28 ≤ Amb. Temp ≤ -2
 - 26 ≤ Snow Temp ≤ -2

Companies	Sample Size
A	5
B	4
C	14
D	4
E	4
F	4
G	3
H	16
Total	63

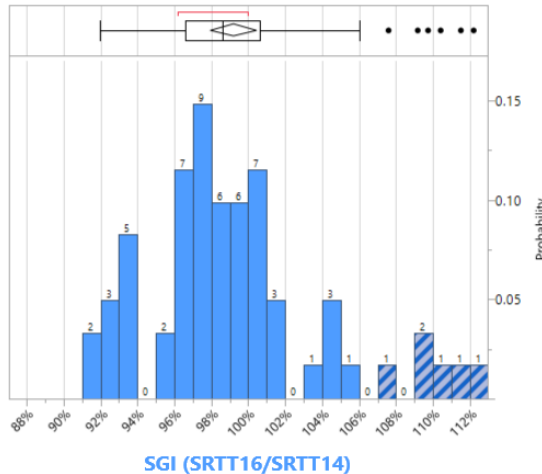
- T-test (all data points):



P-value = 0.2035 > 0.05
 → Mean of SRTTs ratio is NOT significantly different than 1.
 The same conclusion when taking only legal temp range.



SRTT16/SRTT14 ratio		
	All Data points	Data points in Legal Temp range
Mean	0.992	0.99
Std Dev	0.049	0.052
Upper 95% Mean	1.004	1.010
Lower 95% Mean	0.980	0.978
N	61	43
Minimum	0.919	0.919
Maximum	1.122	1.122



- The outlier box plot (also called a Tukey outlier box plot) is used to see the distribution and identify possible outliers.
- For all data, 6 points are detected as outliers.
- For data in legal temp. range only, 4 points are detected as outliers.

SRTT16/SRTT14 ratio (without outliers)		
	All Data points	Data points in Legal Temp range
Mean	0.980	0.980
Std Dev	0.034	0.037
Upper 95% Mean	0.989	0.992
Lower 95% Mean	0.971	0.968
N	55	38
Minimum	0.919	0.919
Maximum	1.060	1.060
p-value (Test hypothesis Mean ≠ 1)		<0.05