Transmitted by the experts of the Task Force Tyre Pressure Monitoring System & Tyre Installation (TPMSTI)

Informal document **GRBP-72-20**
(72nd GRBP, 7-9 September 2020, agenda item 5 (g))

TRL
THE FUTURE OF TRANSPORT

GSR TPMS Testing – validation of proposed amendments to R141

13-20 July 2020

Study on behalf of the European Commission

Open questions for defining the test procedure

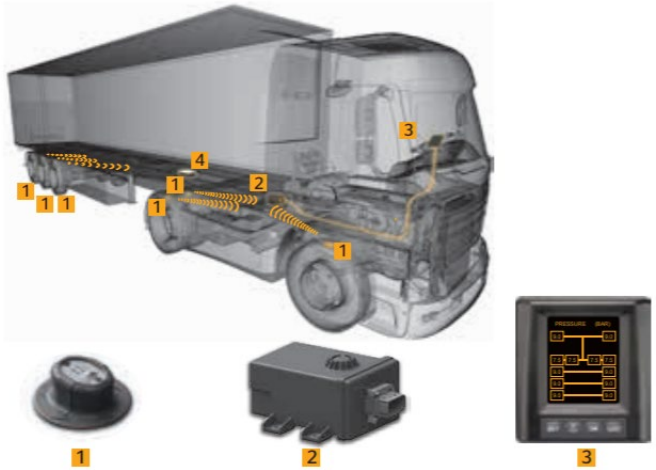
1. Diffusion test - can all vehicle tyres be deflated in a reasonable time period ? What is a reasonable time period, to minimise pressure changes due to temperature changes ?
2. How long does it take for tyre temperatures to stabilise during the learning phases ? Is this influenced by driving speed ?
3. What is the effect of vehicle loading on warming up time ?
4. Can the proposed test procedures be carried out repeatably, reliably, practically ?
5. Any other lessons ?

Test location and vehicles

Tractor unit 3 axle – steer + drive twin + lift
315/70 R22.5 tyres – 5 brands
Trailer 3 axle
One brand 385/65 R22.5 tyres

Bus 4x2 axle configuration
One brand 275/70 R22.5 tyres

TPMS used



1. Tire Sensor
2. Central Control Unit (CCU)
3. Display
4. Additional Receiver

Includes temperature measurement

Test programme

Date	Test	Vehicle	Warmup speed (kph)
13/07/2020	TPMS installation	Bus	-
	TPMS installation	Truck	-
	Tyre deflation	Bus	-
14/07/2020	Tyre warming	Bus	57
	Tyre cooling	Bus	-
	Tyre warming	Truck	57
	Tyre cooling	Truck	57
	Tyre warming	Trailer	57
	Tyre cooling	Trailer	57
15/07/2020	Puncture test	Truck	90
	Malfunction test	Truck	-
	Puncture test	Trailer	90
	Malfunction test	Trailer	-
16/07/2020	Tyre warming	Bus	80
	Diffusion test	Bus	80
	Malfunction test	Bus	-
	Diffusion test	Trailer	90
17/07/2020	Puncture test	Bus	80
	Diffusion test	Truck	90
20/07/2020	Tyre warming	Bus	57
	Tyre cooling	Bus	-
	Tyre warming	Truck	57
	Tyre cooling	Truck	-

Open questions for defining the test procedure

Question 1

Diffusion test - can all vehicle tyres be deflated in a reasonable time period ?

What is a reasonable time period, to minimise pressure changes due to temperature changes ?

Tyre deflation – how long does it take ?

Initial test with bus:

To reduce by 20% ≈ 80 seconds

Deflation times for -20% were measured in the diffusion tests:

Bus:

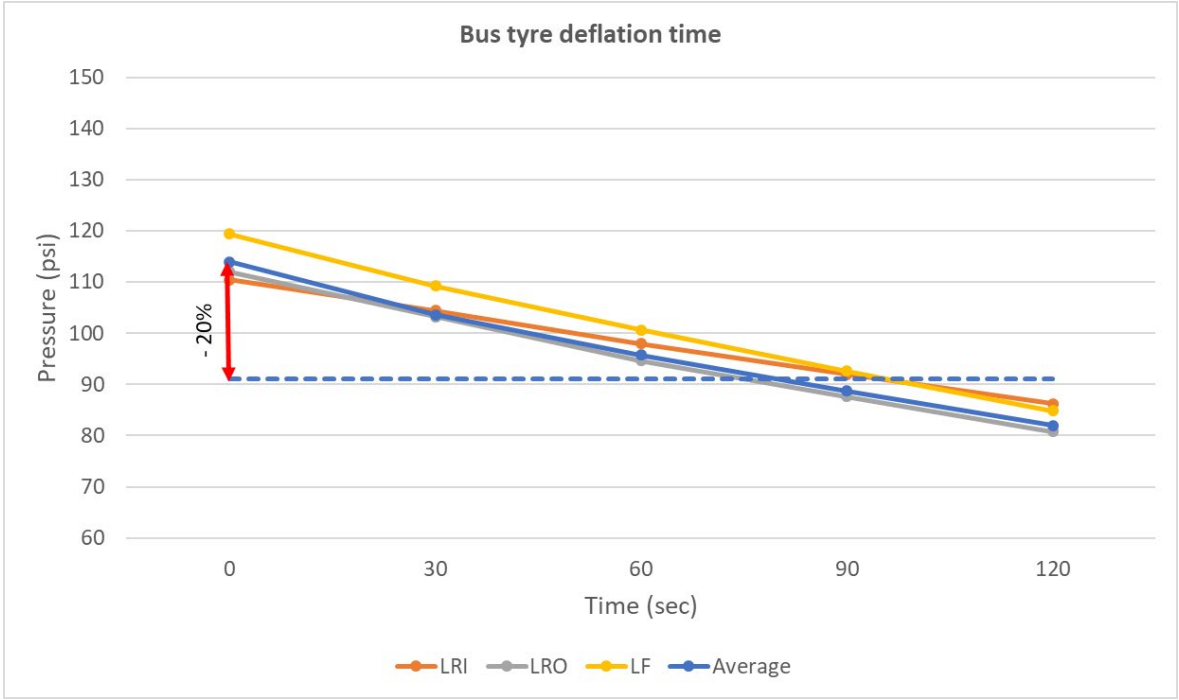
6 tyres / 2 people = 10:53 mins

Truck:

8 tyres / 2 people = 13:48 mins

⇒ 3.5 mins / tyre / person

Additional people were needed for timing and recording



(For reference: 1 psi = 69 mBar)

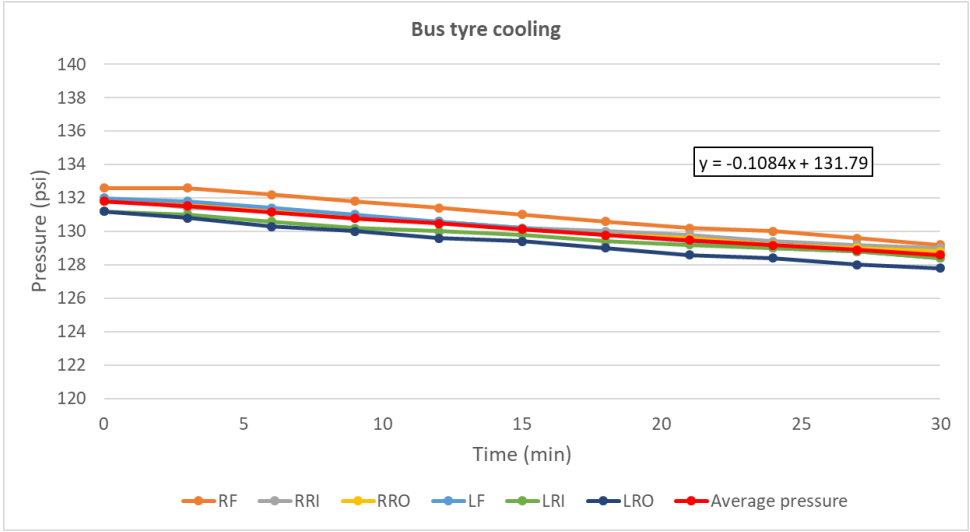
Tyre deflation – temperature / pressure effects with time

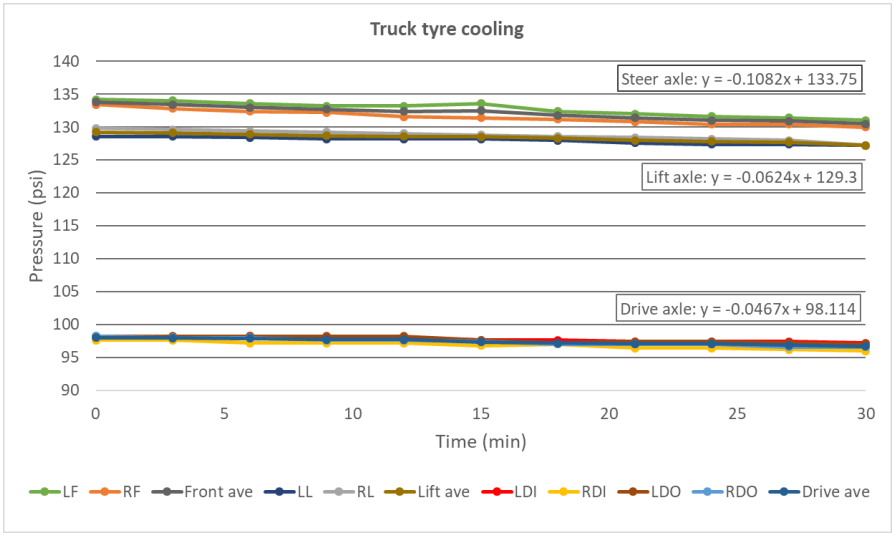
Bus and truck cooling

Bus:

Reduction of 3 psi average in 30 mins

= 0.11 psi / min





Truck:

Reductions of 1.1 – 2.9 psi

= 0.05 – 0.11 psi / min

= 0.6 – 1.1 % in 15 min

Regulatory proposal (Submitted to the experts of TPMSTI)

2.5.2

Procedure for the diffusion test to verify the requirements of paragraph 5.3. to this Regulation.

Deflate **all** tyres within five minutes of measuring the warm pressure as described in paragraph 2.4.3. above **for vehicles of category M1 and N1 and 15 minutes for vehicles of category N2, N3, M2, M3, O3 and O4,** until the deflated tyres are at Pwarm - 20 per cent, plus a further deflation of 7 kPa, namely Ptest. Following a stabilisation period of between two and five minutes, the pressure Ptest shall be rechecked and adjusted if necessary.

Open questions for defining the test procedure

Question 2

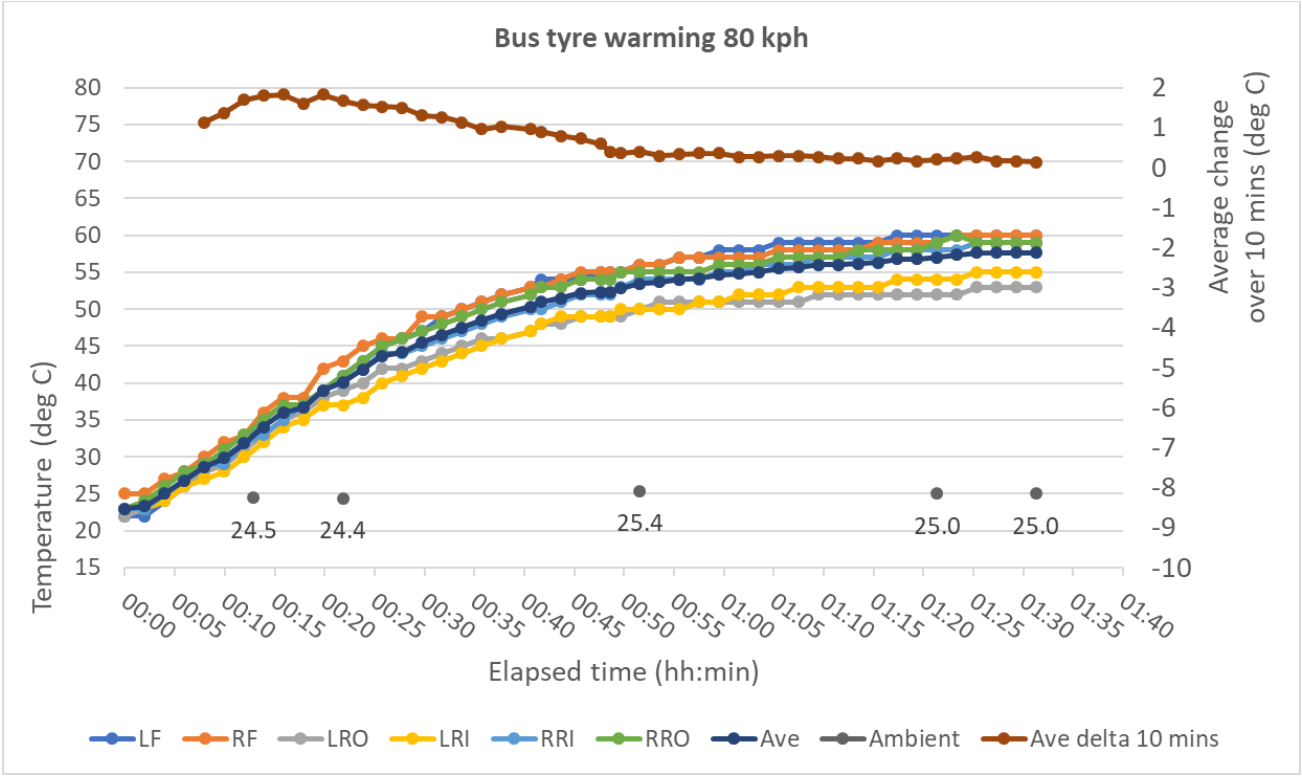
How long does it take for tyre temperatures to stabilise during the learning phases ? Is this influenced by driving speed ?

Tyre warming

Bus puncture test

Temperatures stabilise after

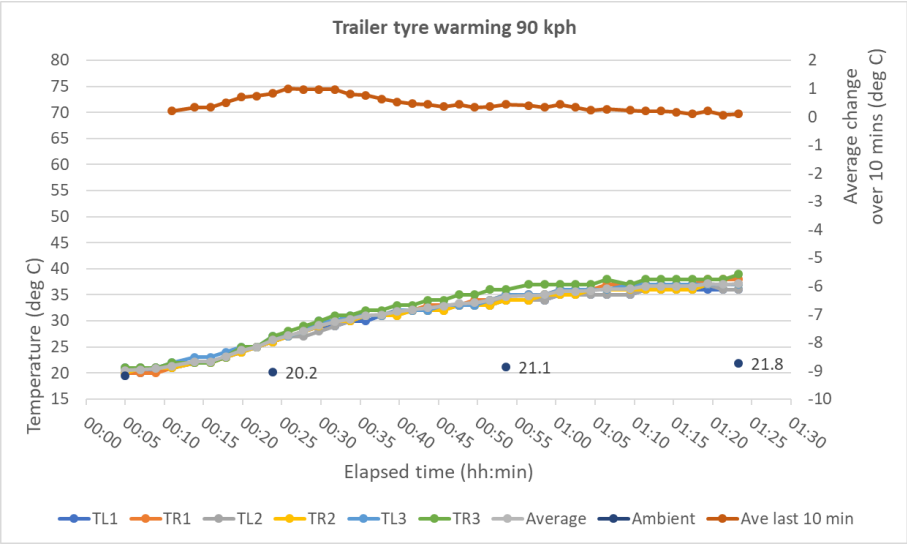
~ 1.25 hour

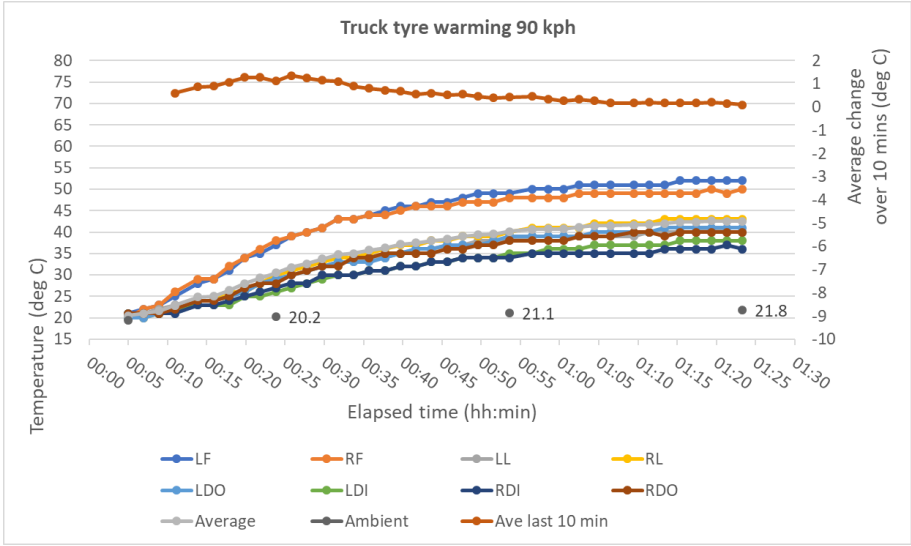


Tyre warming

Truck and trailer diffusion test

Temperatures stabilise after ~ 1 hour





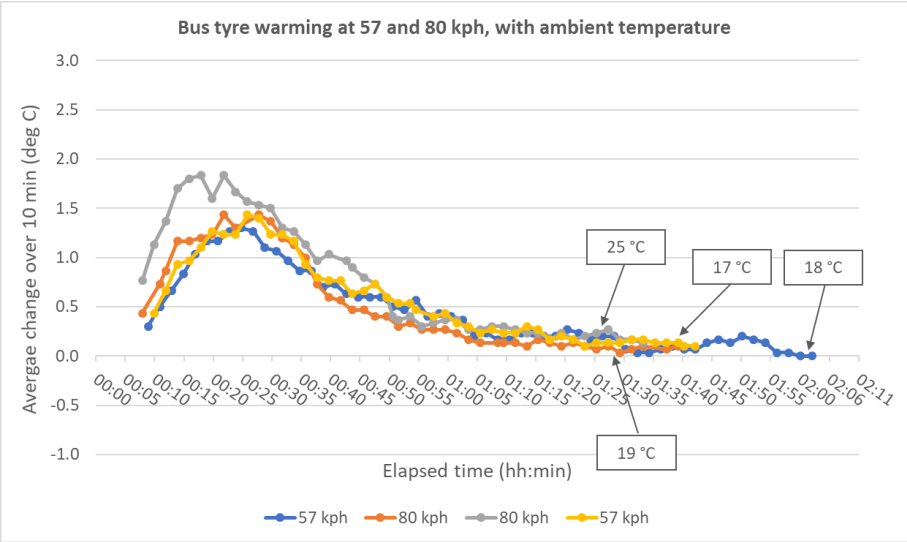
Tyre warming

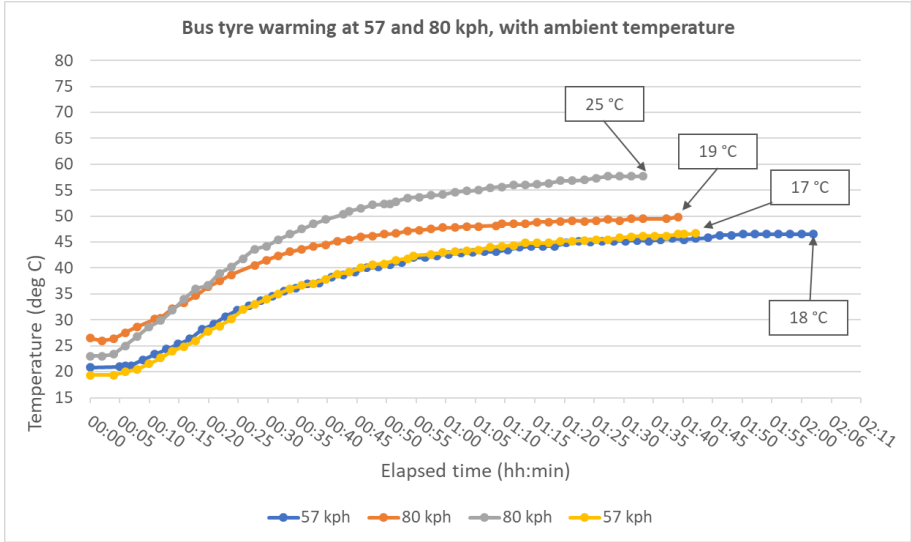
Bus tests compared:

Temperatures stabilise after

~ 1.25 – 1.5 hour

Speed effect is insignificant





Ambient temperature adds to the tyre temperature

Regulatory proposal (Submitted to the experts of TPMSTI)

2.4.1.

For vehicles of category N2, N3, M2, M3, O3 and O4, drive the vehicle for a minimum of 180 minutes at a speed of fifty-seven km/h ±10 km/h.

180 minutes to allow for variations in vehicle type and ambient conditions.

57km/h as mid-point of speed range

Open questions for defining the test procedure

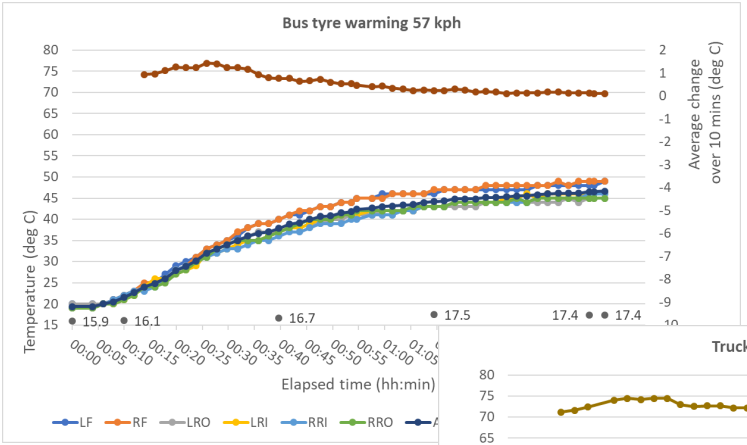
Question 3

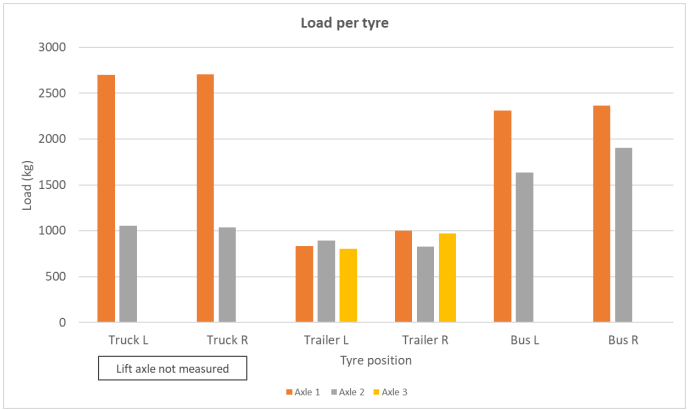
What is the effect of vehicle loading on warming up time ?

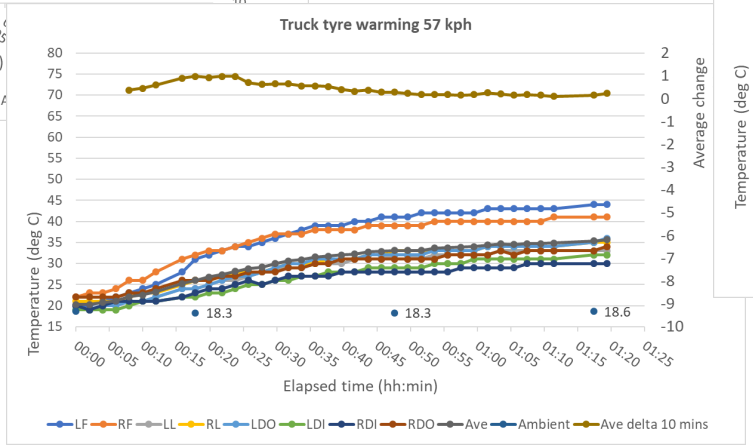
Tyre load

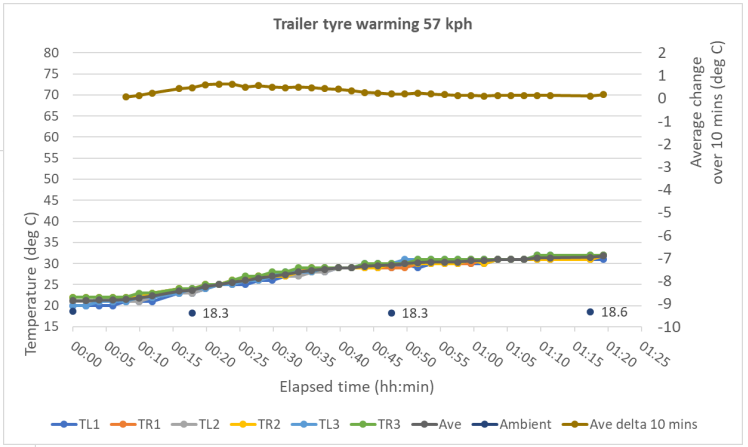
Little effect on warmup time

Temperature reached is higher









Regulatory proposal (Submitted to the experts of TPMSTI)

1.5.1. Test weight

The vehicle may be tested at any condition of load, the distribution of the mass among the axles being that stated by the vehicle manufacturer without exceeding any of the maximum permissible mass for each axle.

No changes to existing R141 text required

Open questions for defining the test procedure

Question 4

Can the proposed test procedures be carried out repeatably, reliably, practically?

The test procedures (puncture, diffusion, malfunction) were followed successfully and repeatably on multiple vehicle types using speed ranges agreed by stakeholders.

Simple equipment and a small number of personnel were required.

Open questions for defining the test procedure

Question 5

Any other learning

Pressure gauges should be used with a high deflation flow rate, or with an additional system for releasing pressure (e.g. an additional valve)

Soak time should be increased – 1 hour is not enough

Regulatory proposal (Submitted to the experts of TPMSTI)

Paragraph 2.1.

Before inflating the vehicle's tyres, leave the vehicle stationary outside at ambient temperature with the engine off shaded from direct sunlight and not exposed to wind or other heating or chilling influences for at least one hour **for vehicles of category M1 and N1 and 4 hours for vehicles of category M2, M3, N2, N3, O3 and O4.**