Submitted by the experts of ETRTO

Informal document **GRRF-86-04**
86th GRRF, 12-16 February 2018
Agenda item 7(b)

ETRTO proposal for UN R30 & 64 amendments


• BACKGROUND
REAL WORLD vs.
RUN FLAT TEST

UN R30 FLAT RUNNING MODE TEST DESCRIPTION

Test criteria		Comments
Drum diameter, *d*	1,7 m *or* 2,0 m	—
Conditioning	3 h at 35 ± 3 °C and 250 kPa	—
Inflation	Valve core removed	—
Speed	V = 80 km/h	to be reached in 5 min, with a speed tolerance of up to ±2 km/h
Load	65 % load index	—
Duration	60 min	
Ambient temperature	(35 ± 3) °C	
Pass/fail criteria	Decrease of no more than 20 % of the deflected section height compared to the start of test, and tread connected to the two sidewalls.	The deflected section height is defined as the difference between the deflected radius, measured from the centre of the rim to the surface of the drum, and one half of the nominal rim diameter as defined in ISO 4000-1.

UN R30 FLAT RUNNING MODE TEST MEANING

- When introduced, Run Flat tyres were supposed to focus mainly on tyre durability performance in flat running mode condition (i.e. zero inflation pressure) and as a consequence, the above mentioned load and speed durability test was designed with this regard.

- The parameters describing the test are resembling an **extreme event** such as a tyre **pressure loss occurring at very high ambient condition, for a fully laden vehicle where the tyre loses its valve, or the tyre has a big hole on the tread**.

- In fact, being the test an indoor one where the tyre is just rolling on a drum test bench, the conditions turn to be **more severe than what really occurring on the road**; for instance the temperature cooling effect due to the air flow is missing and for this reason the tyre heats up much more dramatically than in an outdoor test performed at the same temperature.

- At the same extent it is **really rare that the tyre loses completely the pressure**; instead at least 0.1 bar are still observed, turning into a supporting factor for tyre structure capability.

ACEA DATA ON RF vs. EMT

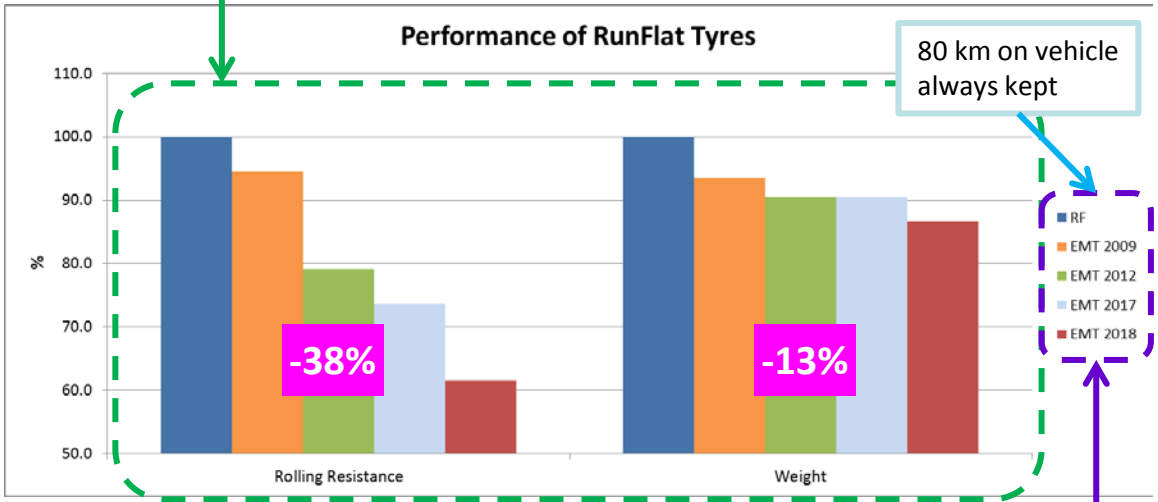
In addition to the performances set for conventional inflated tyres,

OEMs / Tyre Manufacturers needs

- **Rolling resistance improvement** → Fuel consumption / CO_2 reduction.
- **Weight and stiffness improvement** → better NVH (comfort, acoustics).
- **Chassis loads reduction** → enabler for light-weight chassis components and consequent reduction of fuel consumption/CO_2 and safety increase due to reduced inertia.

Considerations

All the performance improvements were obtained without compromising vehicle dynamics **in flat mode**. Running EMT projects still show margin for improvement in weight and rolling resistance. EMT completely fulfils customer expectations as no complaint from the market was received.




• Tyre Industry investigation & OEMs experience

TYRE INDUSTRY STARTING POINT

EMT performance in flat running mode condition needs to be properly described through a laboratory test on tyre, considering that:

- in any case safety shall be ensured
  → sufficient flat running mode range, safe vehicle handling, etc.

- driver satisfaction shall be guaranteed
  → no need for immediate action (side road accidents prevention)

POSSIBLE OPTIONS:

1. To amend current RUN FLAT definition → leading to market confusion
2. To work on a new definition for EMT → clear regulatory framework

Option 2 was chosen to prevent market confusion, while ensuring a clear regulatory framework

VEHICLE MANUFACTURERS ON ROAD TESTS

OEMs experience was useful for Tyre Industry better understanding

OEMs' testing procedures rough overview:

- Test performed on a defined testing track representing real driving conditions, instead of a drum test in a laboratory
- Tyre valves removed (no pressure remaining)
- Speed: max. 80 km/h with moderate acceleration/braking
- Max Lateral acceleration range: 0.3 – 0.4 g
- Pass/fail criteria:
  => Run flat distance to be achieved without impairment of vehicle handling in flat running mode e.g. due to strong vibrations, shaking, ...

Customers Feedback:
Since 2009 more than 7 million vehicles had been sold worldwide fitting EMT, without any customer complaints on insufficient flat running mode performance.

ETRTO DESIGN OF EXPERIMENT – APPROACH

ETRTO did not want to reinvent the wheel, hence starting from the RF test, ETRTO was searching for

- the **best parameters combination capable to properly reflect these products capability** to grant a minimum performance on vehicle: also known as 80 km x 80 km/h;
- more reasonable testing conditions to be **closer to real life** applications;
- **improved testing quality** in terms of repeatability and reproducibility

ETRTO DESIGN OF EXPERIMENT – TYRES SELECTION

ID	SW	AR	R	RIM CODE	LI	SS	SL/XL
1	225	45	R	17	91	W	SL
2	225	60	R	17	99	V	SL
3	255	40	R	18	95	Y	SL
4	195	55	R	16	87	V	SL
5	195	55	RF	16	87	V	SL
6	225	50	RF	17	94	V	SL
7	225	50	R	17	94	W	SL
8	245	50	R	18	100	W	SL
9	255	55	R	18	109	V	XL
10	255	50	R	19	103	Y	SL
11	315	35	R	20	110	Y	XL
12	285	40	ZR	19	103	Y	SL

ALL THESE TYRES GRANT A MINIMUM VEHICLE EXTENDED MOBILITY EQUAL TO 80 km

Different brands / sizes / vehicle applications were selected to investigate the current market performance level and the impact of different testing conditions on those products.

note:
each tyre was tested under different sets of testing conditions by 3 different labs (1 Lab tested all)

THE INVESTIGATION OUTCOME WAS THE BASIS FOR ISO 16992 REVISION

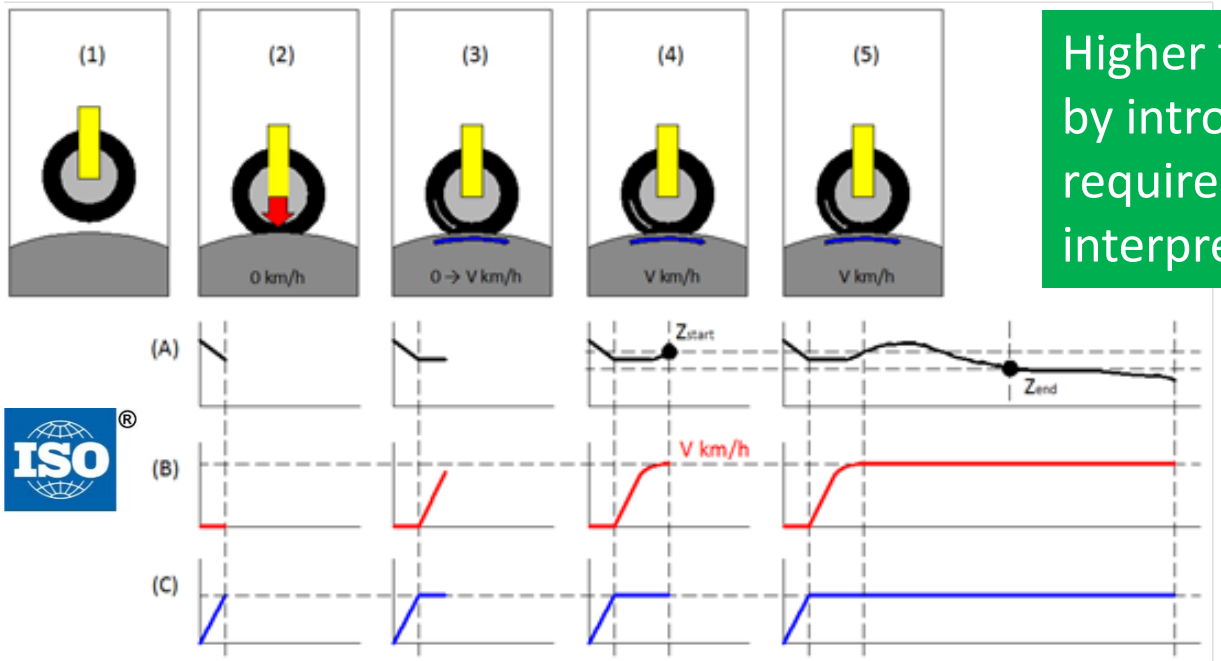
NEW ISO 16992 EMT TEST DESCRIPTION 1/2

- 3.3 new "Extended Mobility Tyres" definition

Test criteria		Comments
Drum diameter, *d*	1,7 m *or* 2,0 m	—
Conditioning	3 h at **25** ± 3 °C and 250 kPa	—
Inflation	Valve core removed	—
Rim	Rim contour with hump (round or flat) on both rim sides Measuring rim width	Rim contour according to ISO 4000-2 Rim width according to ISO 4000-1
Speed	V = 80 km/h if d = 2,0 m V = 75 km/h if d= 1,7 m	to be reached in 5 min, with a speed tolerance of up to ±2 km/h
Load	**60 %** load index	—
Duration	60 min	After reaching the test speed and load condition
Ambient temperature	(**25** ± 3) °C	The sensor shall be at a distance not less than 0,15 m and not more than 1,00 m from the tyre sidewall
Pass/fail criteria	Decrease of no more than 20 % of the deflected section height (Z in the figure) compared to the start of test, and tread connected to the two sidewalls.	The deflected section height is defined as the difference between the deflected radius, measured from the centre of the rim to the surface of the drum, and one half of the nominal rim diameter as defined in ISO 4000-1.

In orange main differences compared to RF test, in green new requirements implemented also for RF test

NEW ISO 16992 EMT TEST DESCRIPTION 2/2



Higher testing quality was achieved by introducing more detailed requirements and preventing interpretations.

(1) Attachment
(2) Apply load
(3) Acceleration
(4) Start of the test Z_{start} triggered
(5) Test continued until Z_{end}

(A) Deflected section height Z graph
(B) Speed graph
(C) Load graph

ISO 16992 symbol for an extended mobility tyre

EMT TEST PARAMETERS DESCRIPTION

Testing Load meaning:

Current RF testing Load value was obtained starting from the vehicle normal load on the road corresponding to 88% LI (max value),

- It was reduced by 20% for drum curvature correction,
- Further reduced by 7% to consider load transfer from a deflated tyre

So: 88% x 80% x 93% = 65%

ISO load 60% LI on the drum corresponds to 81% on the road well reflecting current applications on the market, as per exchanges with Vehicle Industry.

Inflation pressure meaning:

By keeping the zero inflation pressure condition, the test is kept more severe than what observed in real world application, where it is really rare that the tyre loses completely the pressure; instead at least 0.1 bar are still observed, turning into a supporting factor for tyre structure capability.

EMT TEST PARAMETERS DESCRIPTION

TEMPERATURE MEANING:

In accordance to UNECE R30 & 54, where the high speed and endurance tests are made in the range of 20-30°C, also the Extended Mobility Tyres test shall be done at this temperature range allowing a direct link with other performances like e.g. Rolling Resistance, for which the measurement is performed at 25°C.

In addition, to be noted that due to the way the indoor test is conducted, it results much more severe than the outdoor test where

- there isn't the chance to maintain an high temperature constant value;
- there is a cooling effect due to the movement of the tyre and to the air that flows next to it.

As result, in the indoor test the tyre is heated up much more dramatically than in an outdoor test performed at the same temperature.

Higher testing quality was achieved, introducing more detailed requirements.


• EMT as an emergency mobility equipment.

SOLUTIONS AT A GLANCE

Solution

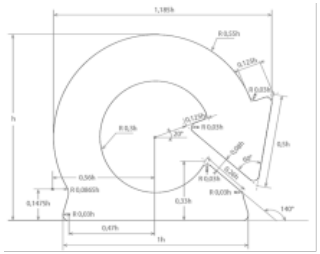
SOLUTION	Spare Tyre	Tempa spare	Tyre repair Kit	„RF“ tyre	EMT
	Search the spare tyre	Search the emergency wheel	Search the tyre repair kit		
SIDE ROAD RISK	Lift the vehicle	Lift the vehicle	Connect the repair kit		
	Dismount the damaged tyre	Dismount the damaged tyre	Able to use the tyre repair kit???		
	Mount the spare tyre	Mount the emergency wheel	Remove the tyre repair kit		
	Put the damaged tyre back in the car	Put the damaged tyre back in the car	Put the tyre repair kit back in the car		
DOES IT WORK?	restart driving If spare not underinflated	restart driving @ limited speed If not underinflated	Restart driving with limited speed if able to use the kit	Keep driving with limited speed for at least 80 km	Keep driving with limited speed for at least 80 km
NEED TO REPAIR	Go to the garage to repair or substitute the damaged tyre	Go to the garage to repair or substitute the damaged tyre	Go to the garage to repair or substitute the damaged tyre	Go to the garage and **check** the damaged tyre	Go to the garage and **check** the damaged tyre

CHECK

UN R.30 AMENDMENT AT A GLANCE

- "Extended Mobility Tyre" describes a pneumatic **radial tyre** designed to operate in an inflated mode and allowing the pneumatic tyre, mounted on the appropriate wheel and in the absence of any supplementary component, to **supply the vehicle with the basic tyre functions at a speed of 80 km/h (50 mph) and a distance of 80 km when operating in flat tyre running mode**.

- **Procedure to assess the "flat tyre running mode“ of "extended mobility tyres"**




Thank you!