



**ETRTO**

The European Tyre and Rim  
Technical Organisation

In coordination with



# Tyres and abrasion

## Tyre Abrasion Rate test development

UN/GRBP-GRPE/TFTA meeting 2022 April 28<sup>th</sup>

# Agenda

- **Reminders of**
  - ETRTO target, approach, what to measure, abrasion impacting parameters
  - Currently available usage conditions
- **Current test program and results**
  - The test parameters used so far
  - The first results and findings
- **Next steps**
  - Fix test parameters range: file scheme
  - Next steps planned by ETRTO
- **Tyre Industry members inputs**
  - Which method(s) studied/recommended by Tyre Industry?
  - Current status and planning of development?
  - What are the market data available?



# Quantifying tyre emitted particles: abrasion rate is the relevant indicator, not tyre mileage!

- Example: Same final mileage, different quantity of rubber to wear



	A	B
Tread depth (mm)	6	9
Tread mass (kg)	1	1.5
Tyre life (km)	50 000	50 000
Abrasion rate (mg/km)	20	30

- **Relevant indicator**

- The best tyre is the one releasing the **lowest quantity of rubber for an identical mileage**, means here the A tyre.
- In this case, the tyre final mileage is not a relevant indicator. The only **relevant indicator is the abrasion rate**

➔ **Relevant indicator for tyre particles emission: abrasion rate, in mG/kM/T (reduced → better)**

# From feasibility phase by ETRTO, 2 options remain

- **For accessibility reasons, we scheduled them as:**
  - Phase 1: On vehicle testing method
  - Phase 2: On drum indoor testing method

Indoor Drum Testing  
(beyond 2024)



Correlation with  
On-vehicle testing

Timeline

Separation Power

Accessibility

Representativity

On Vehicle Testing (Q1/Q2 2023)



2022 June 17th

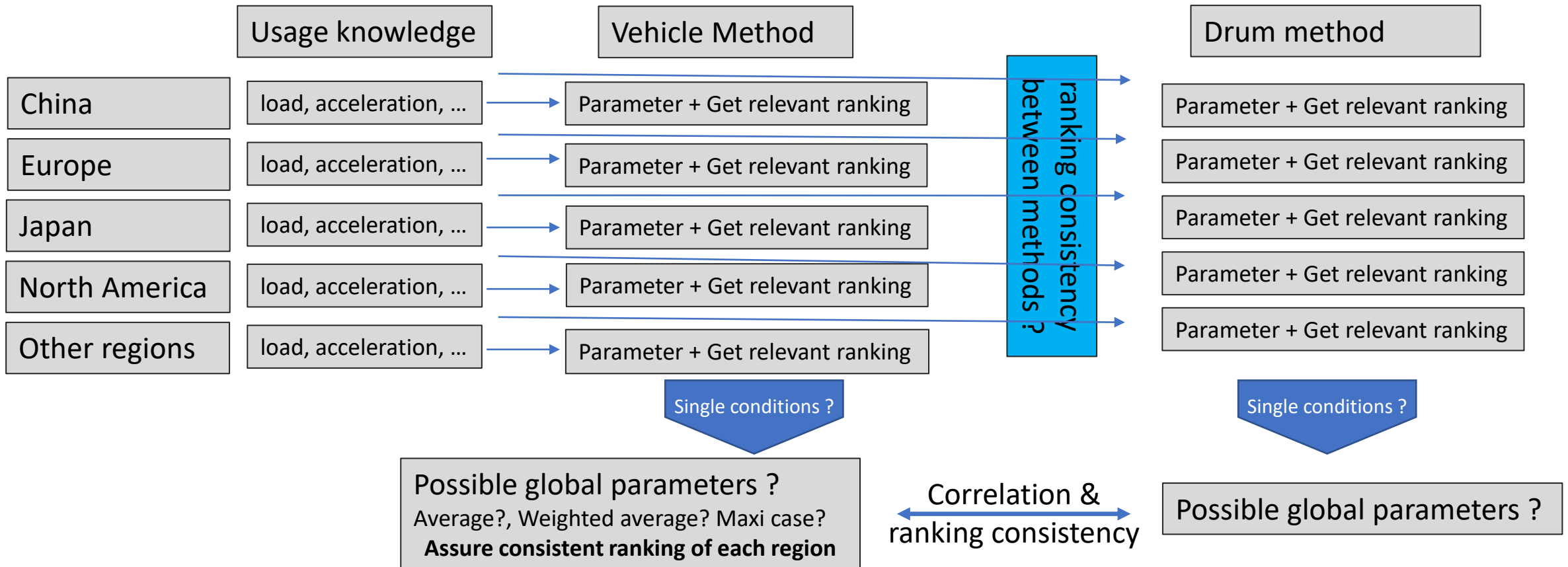
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# ETRTO approach, for test(s) representative of tyre real driving usage

Define the test parameters impacting the tyre abrasion, independent of vehicle :

1. Ambient temperature range and climate
2. Tyre load, pressure, torques, forces
3. Tyre solicitation and usage (X/Y acceleration, running angles...)
4. Type of pavements, micro and macro roughness...
5. Vehicle architecture and design



# ETRTO approach status

- **Most influencing parameters have been established and ranked**
- **Data for usage knowledge have been collected from tyre makers or public sources for Europe mainly and for following topics (already presented)**
  - Road repartition in Europe
  - Road pavements (partial)
  - Weather data
  - Acceleration histograms (4 major countries, ~3600 vehicles, 15 millions of trip, 150 millions of kilometers)
- **These data have been used to draft the vehicle abrasion test method**
- **ETRTO**
  - Assess WLTP cycle for longitudinal tyre solicitations
  - Currently working with other tyre regional organizations to develop the usage knowledge for each interested regions. Next step will be to determine if global parameters (including WLTP) would be relevant.





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# Parameters impacting the tyre abrasion Currently available usage knowledge

# Most impacting parameters, to master for Vehicle Test Method

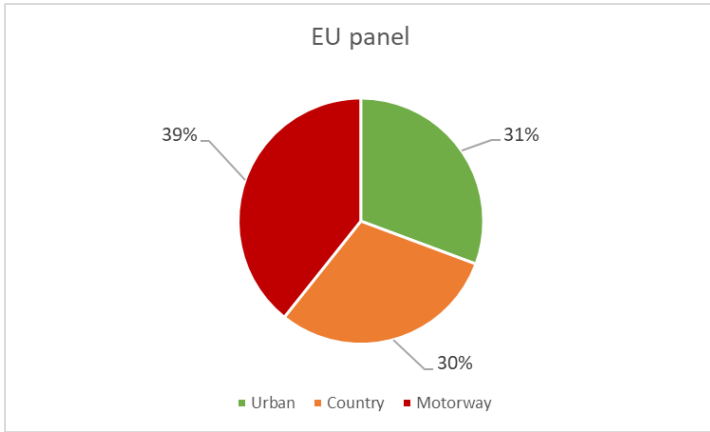
- **ETRTO proposal to start is an on-Vehicle test method running convoy with several vehicles with same controlled conditions on a defined test route on public roads**
  - A reference tyre in each convoy is required
    - to mitigate the impact of outside parameters on absolute abrasion rate
- **Main parameters to master to avoid dispersion**
  - Road & Driving Style
    - Circuit on public roads, Road types, Pavement surfaces
    - Speed & Acceleration Distributions
  - Vehicle type & Settings
    - Targeted tyre load in % LI
  - Weather impact
    - Temperature range for testing
    - Rain: limited % of wet roads, no snow or ice



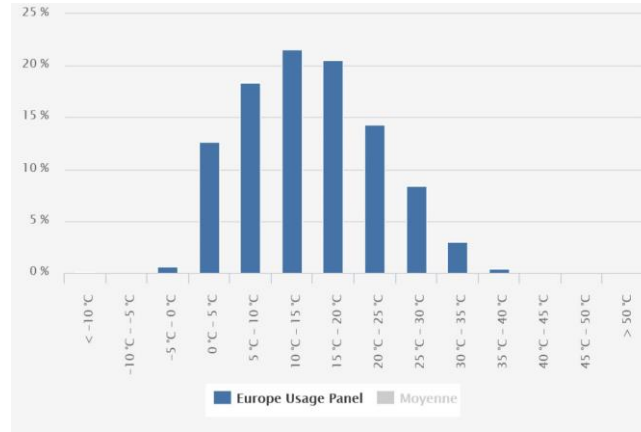


# EU usage parameters summary (roads, weather, speeds, acceleration)

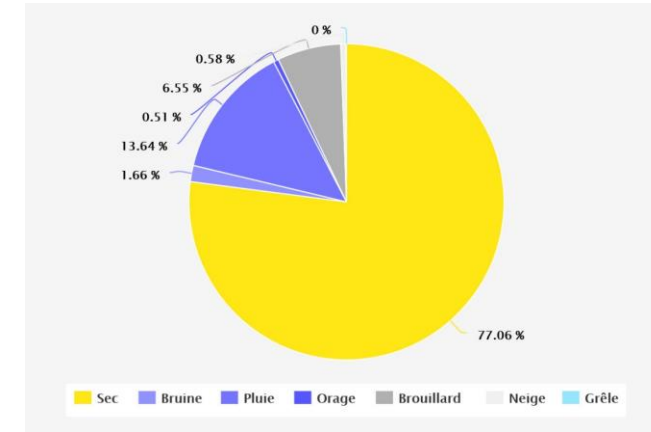
Roads



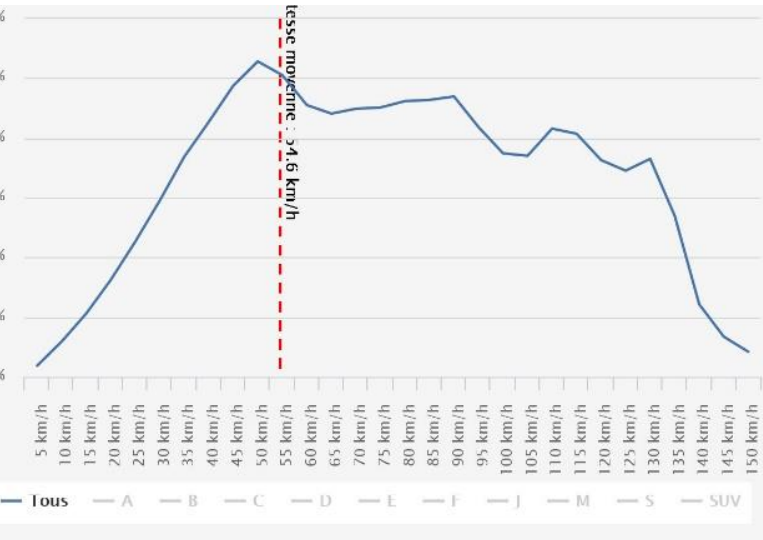
Temperature



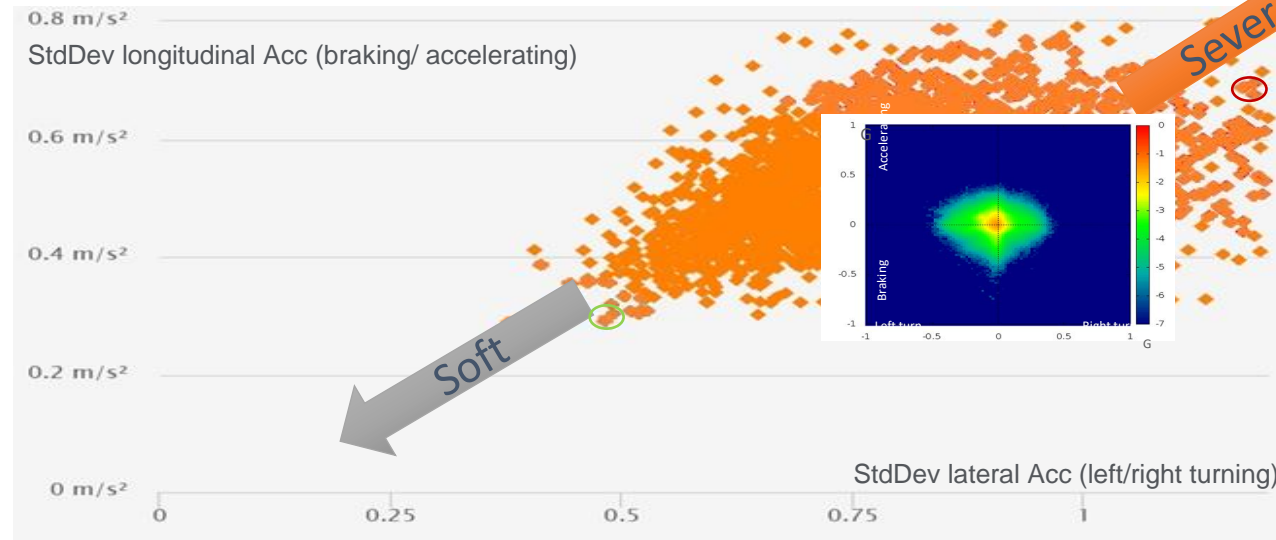
Weather



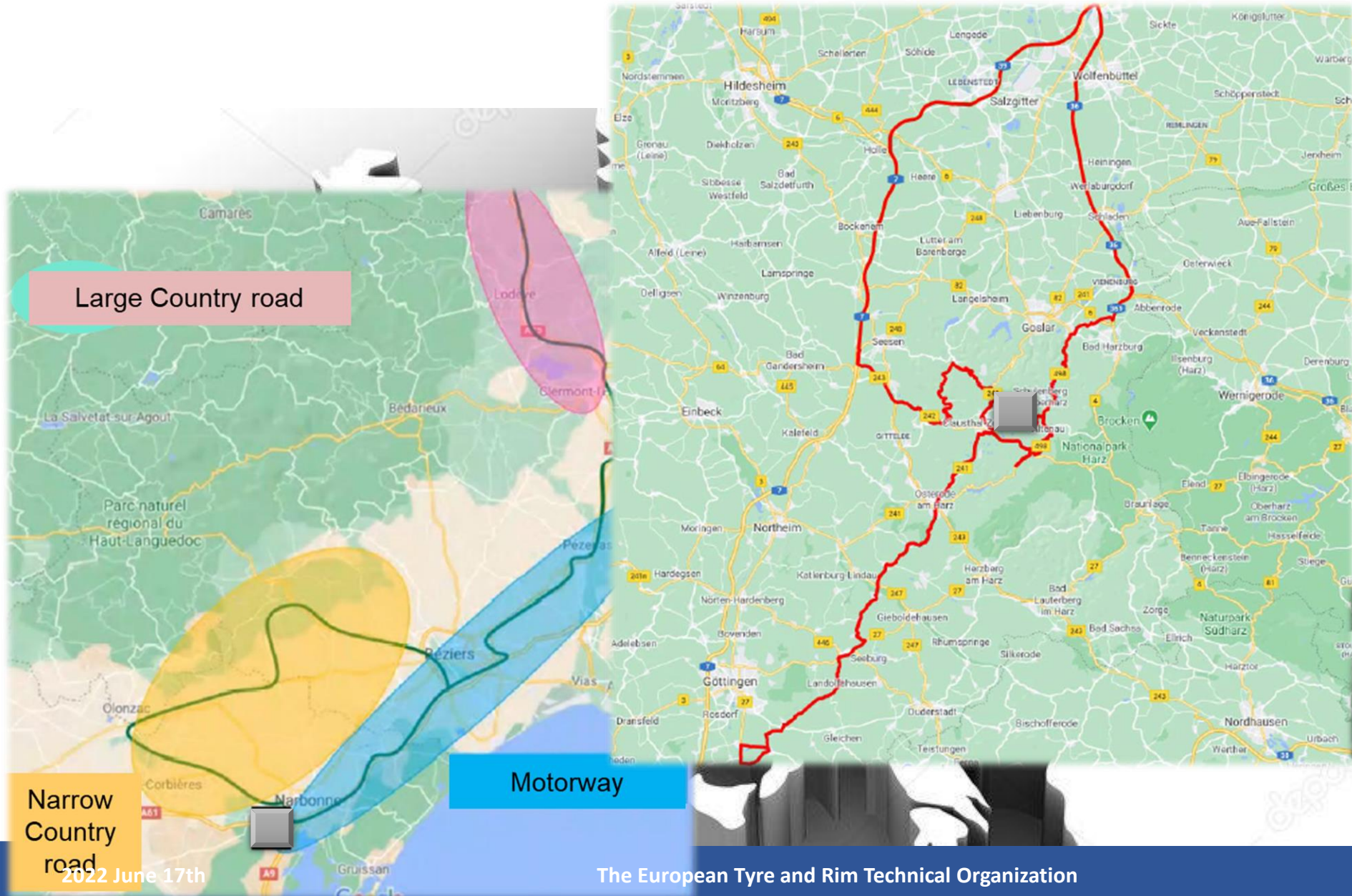
Speeds



Acceleration



# Candidate « Summer » and « Winter » circuits



## Next ETRTO activities and next presentation to GRBP-GRPE TFTA

- **ETRTO currently developing and fine tuning the vehicle method proposal for tyre abrasion rate measurement**
  
- **During next TFTA meeting, ETRTO proposes to:**
  - Present the first results of 2021 test plan, showing parameters impact
  - Explain the vehicle method draft parameters
  
- **ETRTO suggests to other regions and stakeholders to share available regional parameters and data, and to prepare together a synthesis for TF TA**



# Example of ETRTO test parameters for experimental test

Test title purpose	Understand the winter reference tyre abrasion performances and variation linked to temperature variation					
General description:	Candidate reference tyre to be tested on winter circuit, accompagnied by 2~3 other brands to tyres @ 2 temperatures					
Vehicle	Same vehicle for all the tyres, same as last year or used on other circuit.					
Measurement	Perfbox IFV (+ Danlaw provided by ETRTO on one vehicle on Golf 8 to confirm					With or without urban part?
End test	10 000	Repetition	2	Total distance	20 000	
Circuits	Neuer Streckenvorschlag ETRTO_01_Processed.vbo without urban driving					11 IFV Proposal 07.06 1
Mass measurement without wheel:	at the beginning and at the end of the test (8 km suppressed)					+/- 1 gramme
Mass measurement with wheel:	each 2000/2500 km, including 0 and end of the test (to be done without valve to insure 0 pressure)					+/- 1 gramme TBD
Tread wear measurement (5 points) :	each 2000/2500 km, including 0 and end of the test					Not needed for final method, only for definition test
Minimal temperature during test:	5	10				Average during the 2 coldest hours of the test day
Maximal temperature during test:	15	20				Average during the 2 hottest hours of the test day
Average targeted temperature	10	15				Daily average during the vehicle running time
Maximal percentage of distance with Rain	15%	15%				
Tyre selection	By tyre maker, age < 2 years, same dot/plant, including spare at least one					
Tyre rotation at each shift	No					
Tyre rotation at each cycle	Yes	Rotation at each cycle, together with measurement, at same vehicle position				
Rotation vehicle in convoy	Yes	Frequency?				
Drivers rotation between vehicles	Yes	One drive per shift, change between shift only. If possible without COVID restrctio				
	Vehicle 1	Vehicle 2	Vehicle 3	Vehicle 4		Remark
Tyre size	225/45R17 94	225/45R17	205/55R16	205/55R16		
Tyre brand	Réf. SRTT winter	Brand 1	Brand 2	Brand 3		Tyre brand/pattern to confirm
Tyre pattern	BFG	Pattern 1	Pattern 2	Pattern 3		20 tyres + spare
Wheel width	7.5	7.5	7.5	6.5		
Front load	480	480	480	480		Used by Dekra on Golf8 previous tests
Rear load	325	325	325	325		Used by Dekra on Golf8 previous tests
Front pressure	250	250	250	250		Pressure to confirm
Rear pressure	250	250	250	250		Pressure to confirm
Vehicle	Golf 8	Golf 8	Golf 8	Golf 8		
Vehicle transmission	Automatic	Automatic	Automatic	Automatic		identical on each vehicle
Vehicle engine type	2.0 TDI 110 kW	2.0 TDI 110 kW	2.0 TDI 110 kW	2.0 TDI 110 kW		identical on each vehicle
Drive axle TOE max	Adjust to 10'	Adjust to 10'	Adjust to 10'	Adjust to 10'		identical on each vehicle
Drive axle camber	-30' not adjustable	-30' not adjustable	-30' not adjustable	-30' not adjustable		identical on each vehicle
Non driven axle	Adjust to 10'	Adjust to 10'	Adjust to 10'	Adjust to 10'		Conform to Car maker specifications
Total vehicle load	1610	1610	1610	1610		



# ETRTO 2021 test campaign results

- See presentation of 2021 tests results.



# Current/Next ETRTO WG activities

## 1. Test method parameters proposal

- See excel file [Abrasion method parameters D3 AR.xlsx](#)
- This file is under construction, draft could be presented next meeting

## 2. Test method dispersion measurement

- ETRTO currently preparing a process and test plan to measure the test method dispersion, targeting to assess the impact of following parameters:
  - temperature,
  - vehicle,
  - usage variation,
  - road surface variation
- Draft could be presented next meeting

## 3. Method/Circuit comparison test

- ETRTO currently preparing a process and test method to compare circuits and methods
- Draft could be presented next meeting

## 4. State of the art (need to have fixed all previous point 1,2,3 fixed)

- ETRTO currently preparing proposal to assess the state of the art, allowing to fix a future suitable threshold for tyre abrasion rate



# Conclusion

- **By 2023, EU Tyre Industry is committed to deliver a test method**
  - supporting regulatory action on TRWP mitigation,
  - allowing the inclusion of abrasion rate in the tyre regulatory framework
  - representative, fair, robust and reproducible, fine tuning many influencing test parameters, using tyre industry expertise and market knowledge
- **As first step, the method will be on-vehicle based, measuring tyre Abrasion rate (mg/km/T)**
  - in a relative manner to known reference tyres,
  - representative of real driving conditions,
  - open to all test suppliers, testing organisation and countries.
- **Drum method development to be planned**
  - ETRTO planning to join JATMA efforts from 2022 September, updating the existing plan and knowledges.





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Many thanks for your attention



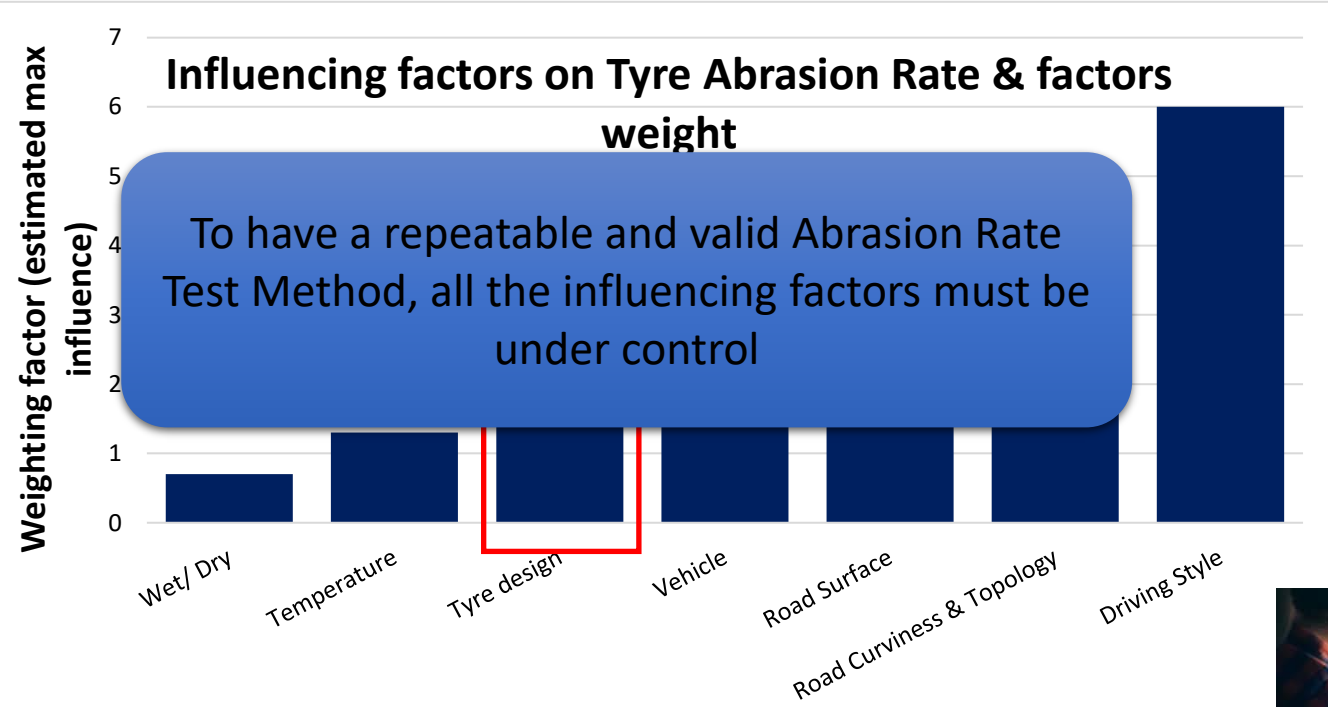
# Impacting factors on tyre abrasion rate

- **Road & driving style** are the predominant factors influencing abrasion rate:

Road design as well as driver's training are **major levers of progress** to decrease abrasion rate and related particle release.

- **Tyre design**, even if not the main one, is however a relevant factor to impact rubber wear emission that needs to be addressed.

➤ An holistic approach is to be considered to achieve best improvements



# Which usage can be representative for Europe?

- **Collecting Europe usage tracking Data Base from Tire Manufacturers**

- All over Europe
- 3555 vehicles
- All Passenger Car Market segments
- Since 2015
- 15 Millions of trips
- 150 Millions of kilometers

- **Roads are split in**

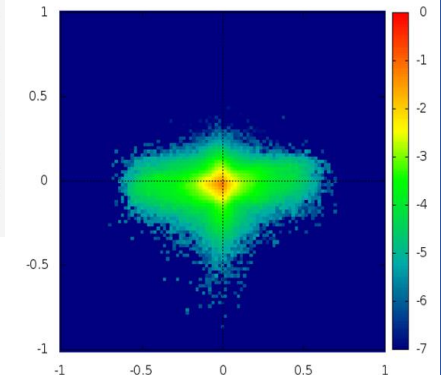
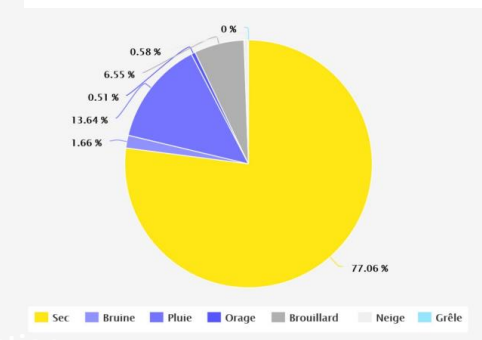
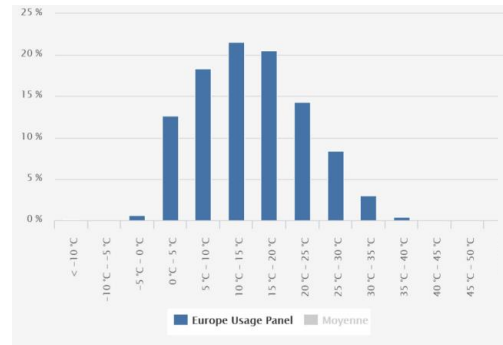
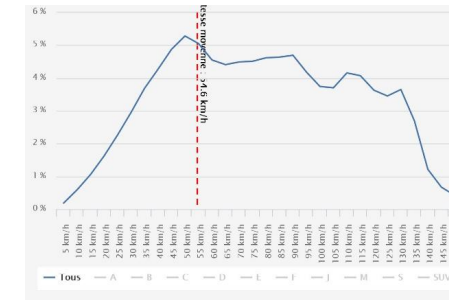
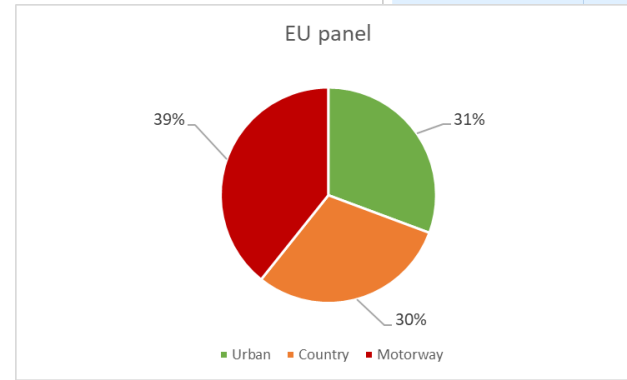
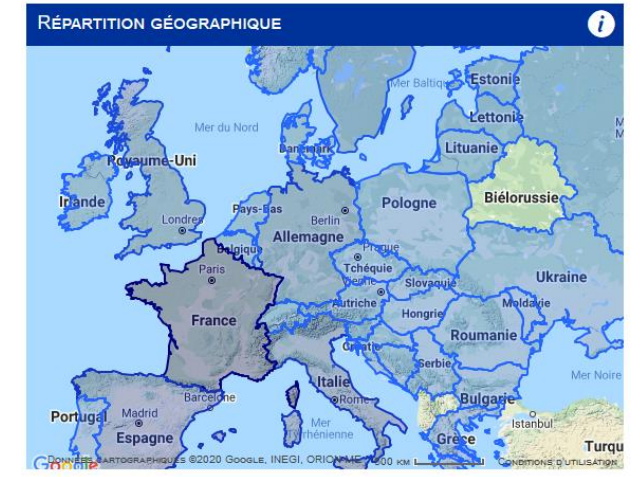
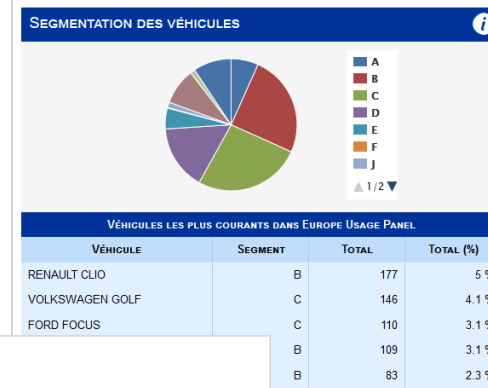
- Urban, Rural, Highway
- using OpenStreetMap definitions

- **Driving Style Statistics**

- Speed & Acceleration distributions

- **Weather Statistics**

- Temperatures & Wetness

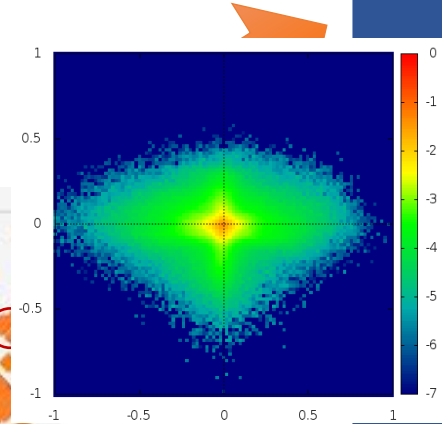
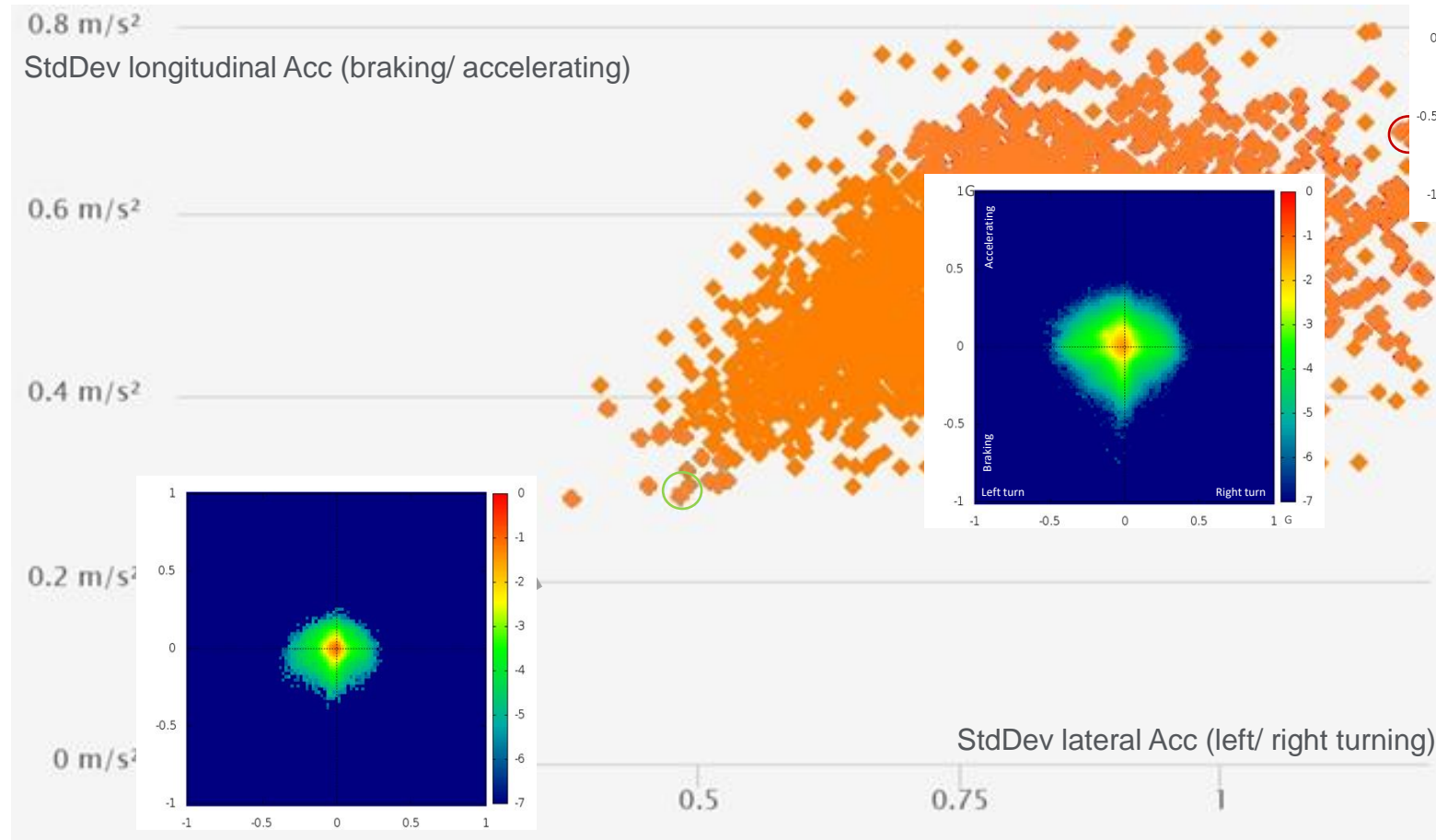


# Distribution of European Driving Styles (X/Y Accelerations)

- EU usage Data Base reveals the range and variety of severities

Targeted Usage for Abrasion Test

- Each point from graph beside represents the range (StdDev) of X & Y accelerations for one single vehicle over several ten thousands of km



# Clustering the Tyre Market for better reproducibility

- Tyres should be separated in Clusters such as: « Summer » No 3PMSF & « Winter » 3PMSF

- One circuit + One Reference Tyre for each cluster
  - “circuit” = “test route on public roads”

- Each circuit should be located to match actual temperatures for tyre use in each cluster:

- EU usage tracking Data Base gives actual temperatures
  - by Map-matching weather records with vehicle location through time-stamp
- Winter (Northern Europe) Temperatures
  - Range [0 ; 20°C] - Mean ~ 7,5°C
- Summer (Europe) Temperatures
  - Range [10 ; 35°C] - Mean ~ 23°C

- Other circuit specifications

- Road Mix: Urban, Rural, Highway
- X/Y acceleration histograms
- Speed range

