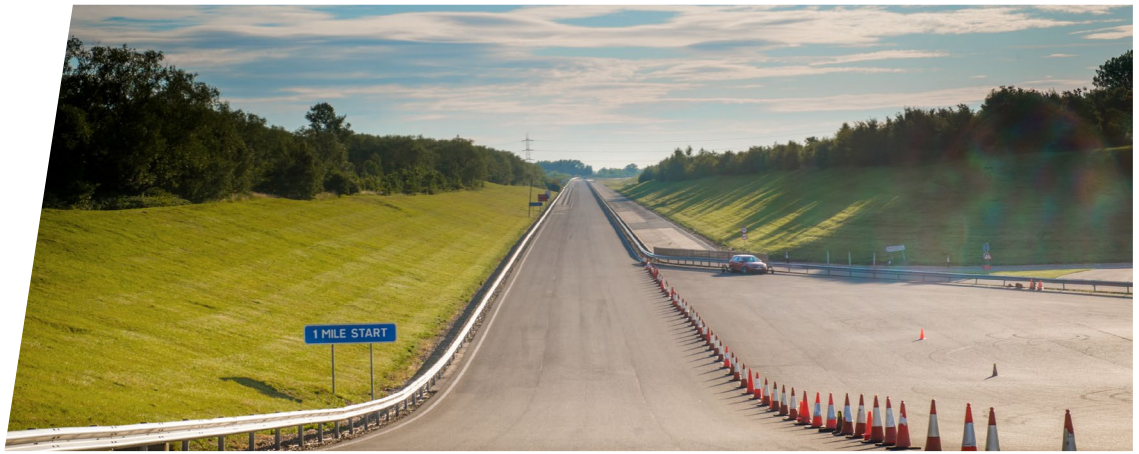
Informal Document GRBP-78-32
78th GRBP, 30 Aug – 01 Sept 2023
Agenda Item 7e
Submitted by OICA



UTAC

Tyre Abrasion Study for ACEA

78th GRBP

CONTENTS

- Tyre Abrasion Study Overview
- WP1 – Literature Review
- WP2 – EPREL Tyre Database Analysis
- WP3 – Real Life Testing
- Next Steps

TYRE ABRASION STUDY OVERVIEW

- Scope:
  - Theoretical and experimental study of influencing factors on tyre wear / abrasion.
- Objectives:
  - Review GRBP TF TA tyre abrasion requirements proposal: test method, interdependency evaluations, etc,
  - Quantify differences in tyre wear / abrasion in relation to vehicle type (ICE vs BEV),
  - Quantify possible differences between OE and Aftermarket tyres by testing tyres with different label values.
- Work Packages & Timing:

Work Packages		Timing
WP1	Literature Review	Jun-23 (completed)
WP2	EPREL Tyre Database Analysis	Aug-23 (completed)
WP3	Real Life Testing	Aug-23 (ongoing)
WP4	Test Results Analysis	Sept-23
WP5	Presentations to GRBP/GRPE: - Interim report: - Final report:	 GRBP 78th session GRPE 90th session / GRBP 79th session

WP1 – LITERATURE REVIEW - SCOPE

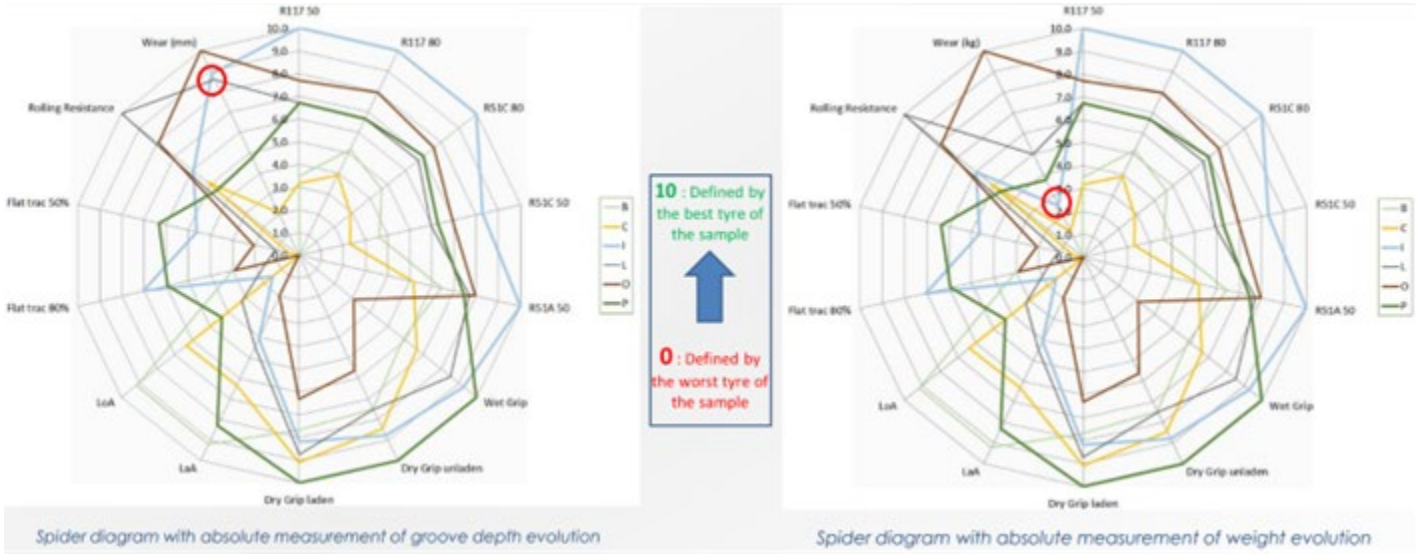
- Tyre abrasion and mileage for:
  - C1, C2 & C3 tyres,
  - Summer & 3PMSF tyres.
- Aspects considered:
  - Driving behaviour influence on tyre wear / abrasion,
  - Vehicle design influence on tyre wear / abrasion,
  - Tyre performances interdependency,
  - Tyre wear / abrasion testing,
  - Tyre & Road Wear Particles (TRWP) emissions.
- Review included, but was not limited to, relevant studies presented in GRBP TF TA.

WP1 – LITERATURE REVIEW - FINDINGS

- Main influencing parameters with regards to tyre wear /abrasion reviewed in terms of:
  - Vehicle design: increased tyre wear expected with BEV vs ICE, due to:
    - Increased weight (current BEV weight estimation: ICE + 20-25%),
    - Higher level of instantaneous torque,
    - Regenerative braking system.
  - Driving conditions: longitudinal and lateral accelerations more critical than speed alone.
  - Road surface,
  - Ambient weather conditions.

WP1 – LITERATURE REVIEW - FINDINGS

- Tyre performances interdependency:
  - Tyre wear / abrasion vs rolling resistance: good level can be achieved for both performances, depending on:
    - Strategy chosen during tyre development,
    - Type of tyre considered (ie: eco vs high performance / sport).
  - Tyre wear / abrasion vs rolling noise: good level can be achieved for both performances, depending on:
    - Strategy chosen during tyre development,
    - Type of tyre considered (ie: eco vs high performance / sport).
  - Tyre wear / abrasion vs safety: challenging to achieve good level for both performances:
    - Investments required in development and implementation of innovative technical solutions.



Spider diagram with absolute measurement of groove depth evolution

Spider diagram with absolute measurement of weight evolution

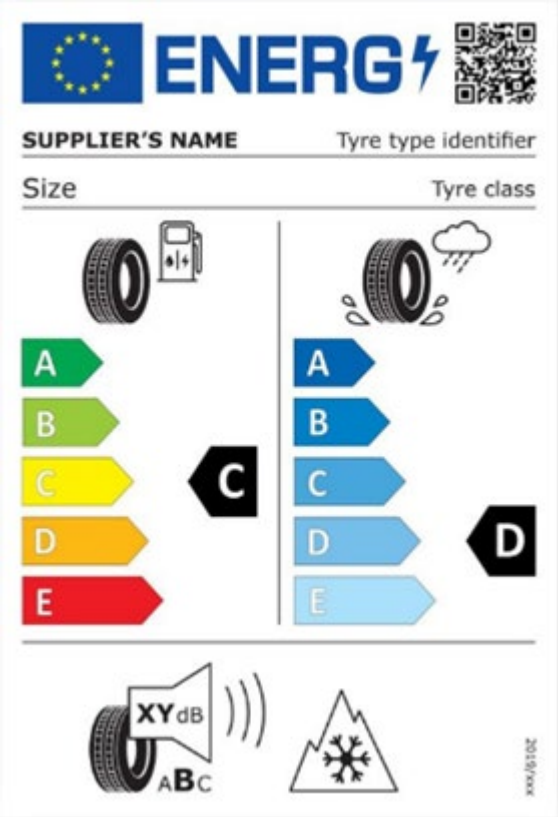
(UTAC, TA-03-04 OICA GRBP-75-19-Rev.1)

WP1 – LITERATURE REVIEW - FINDINGS

- TRWP emission:
  - Very complex vs tyre wear / abrasion studies,
  - Testing methodologies: challenges to generate, collect and quantify TRWP over the relevant particles size range in a representative and accurate way,
  - Particle size distribution: increased driving severity leads to increased share of fine and ultrafine particles.
- Tyre wear / abrasion & TRWP information availability:
  - C1 tyre: information available but limited number of studies found on BEV influence on tyre wear / abrasion and tyre performances interdependency,
  - C2 tyre: limited information available,
  - C3 tyre: scarce information available.

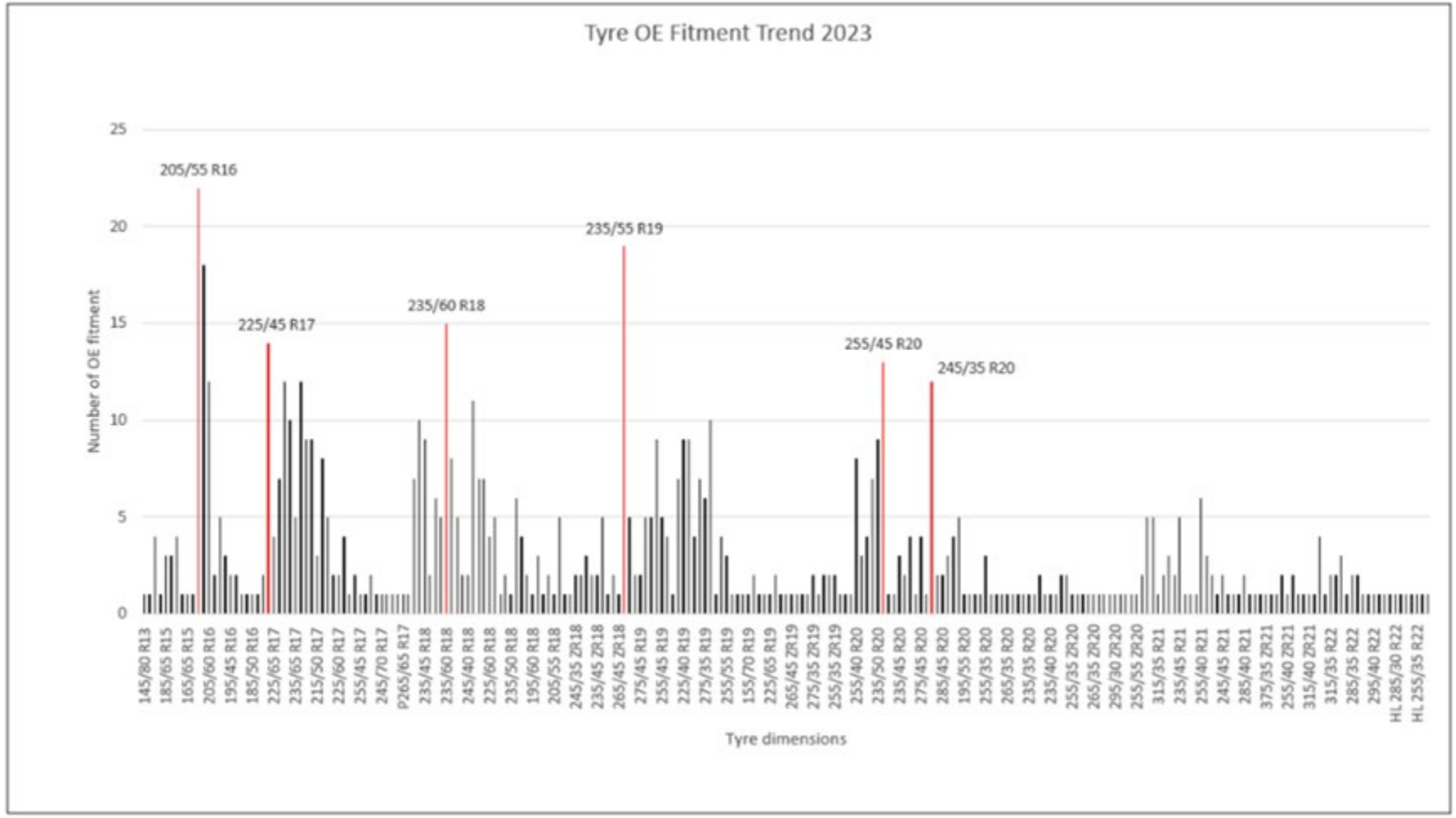
WP2 – EPREL TYRE DATABASE ANALYSIS

- Objective:
  - To quantify possible differences between Original Equipment (OE) and Aftermarket tyres in terms of market penetration and label values (rolling resistance, wet grip and external rolling noise) as per European Union (EU) regulation 2020/740.
- Scope:
  - European market,
  - Mainstream vehicle OEMs (M1, N1, M2 & N2),
  - C1 & C2 tyres,
  - Summer & 3PMSF tyres.
- Methodology:
  - Identify, based on internet search, OE tyre sizes and labelling information per vehicle category, vehicle segment and powertrain,
  - Extract tyre label information from European Product Registry for Energy Labelling (EPREL) tyre database (EPREL Public website (europa.eu)) for corresponding tyre sizes,
  - Identify Aftermarket and OE tyre label references,
  - Analyse OE vs Aftermarket tyre labels.



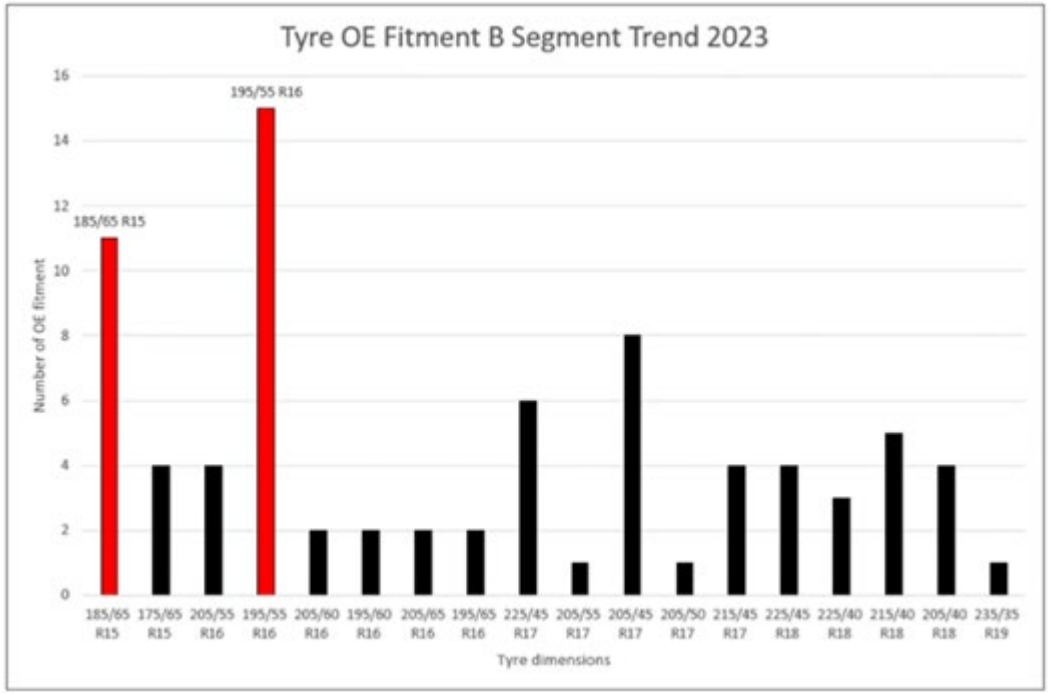
WP2 – EPREL TYRE DATABASE ANALYSIS

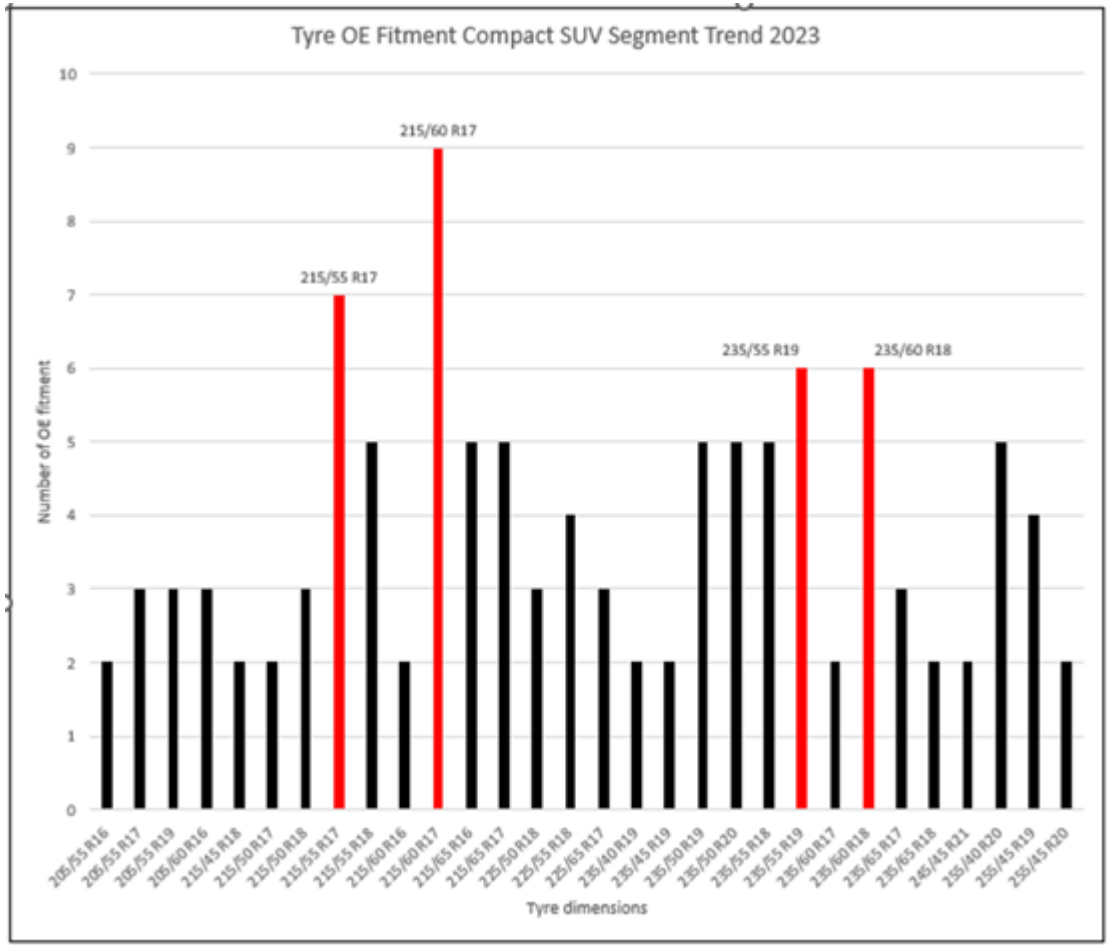
- Analysis Results – C1 Tyres:
  - Tyre sizes with the most OE fitments in Europe:



WP2 – EPREL TYRE DATABASE ANALYSIS

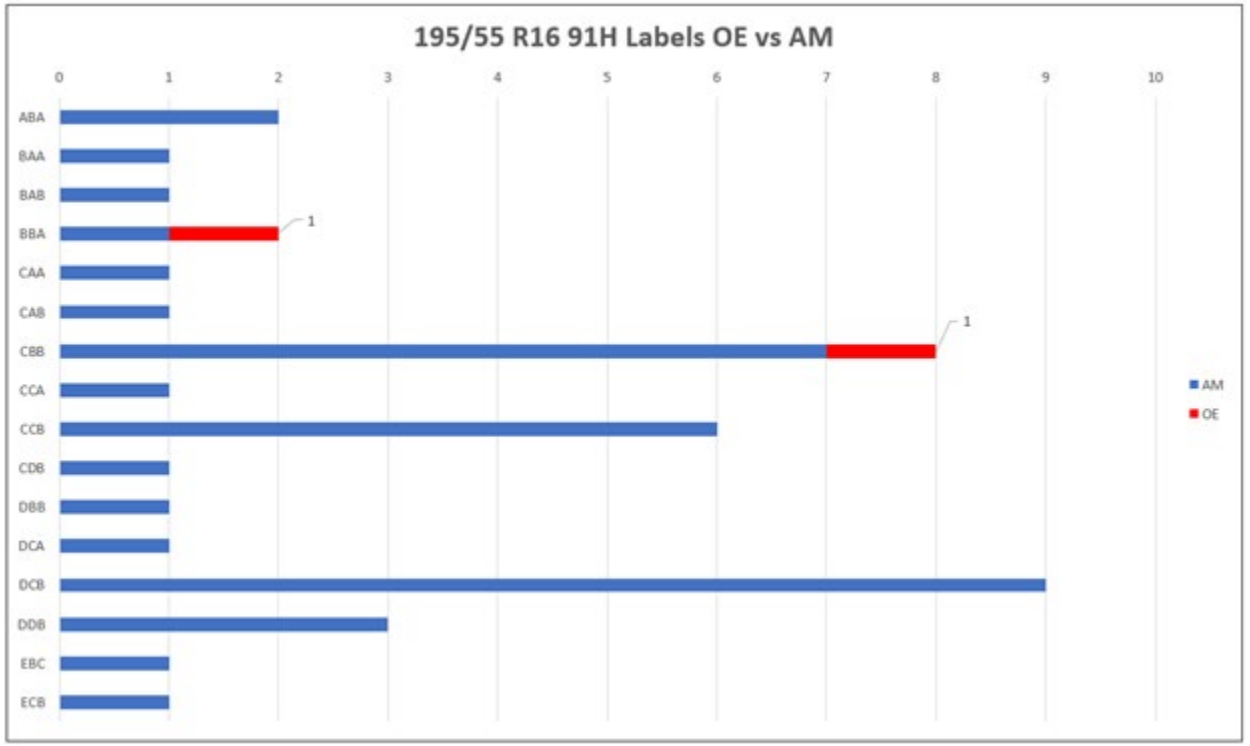
- Analysis Results – C1 Tyres:
  - Tyre sizes with the most OE fitments per vehicle segment – examples for B and compact SUV segments:



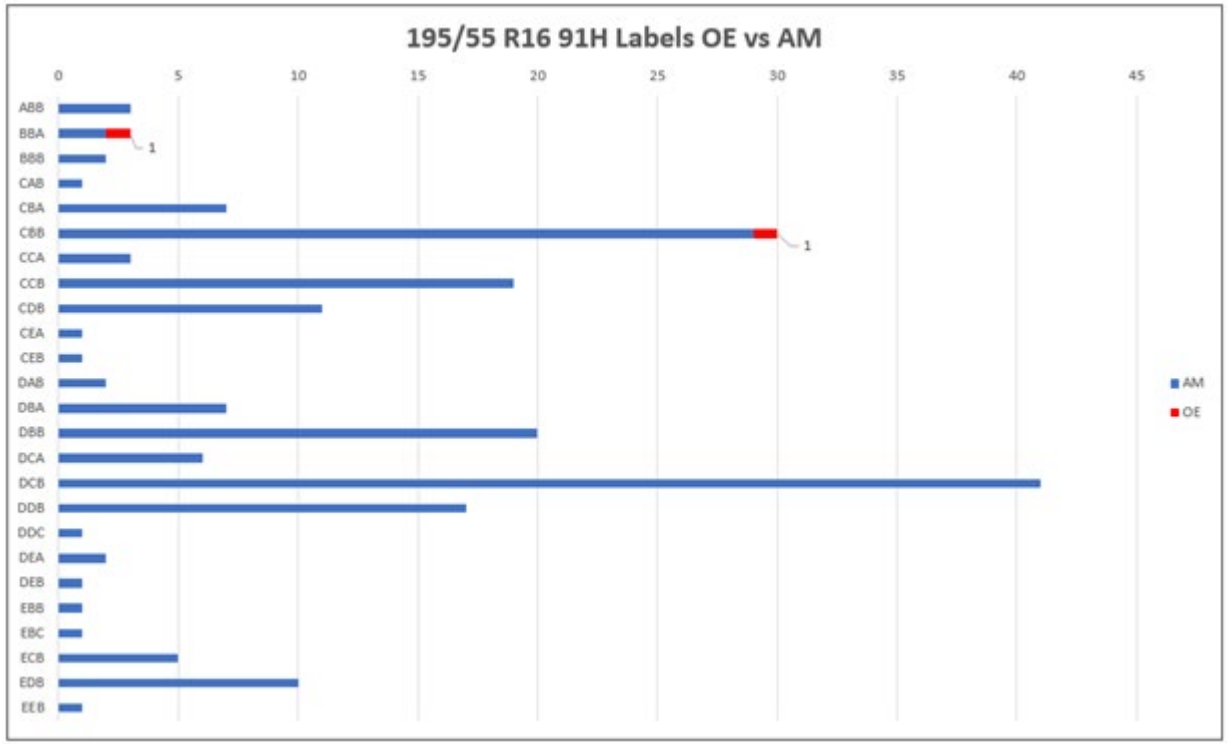


WP2 – EPREL TYRE DATABASE ANALYSIS

- Analysis Results – C1 Tyres:
  - OE vs Aftermarket Tyre Labels[1] – example for vehicle B segment:



195/55R16 91H - Summer

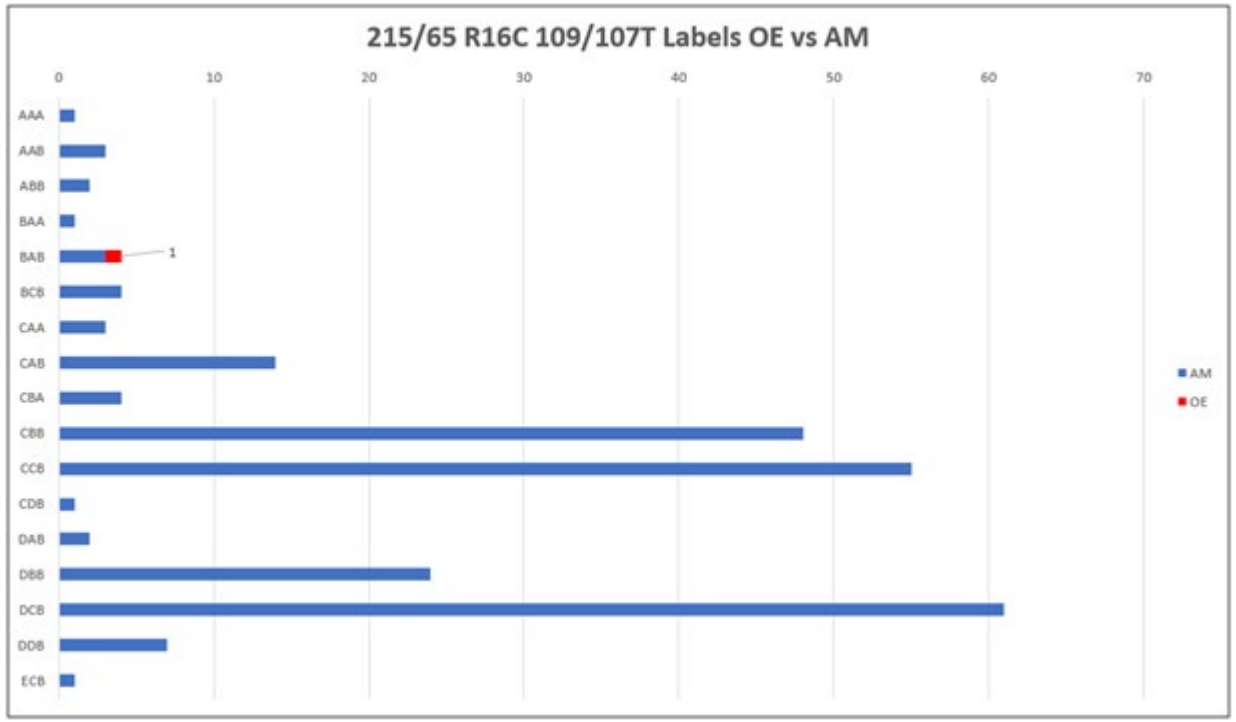


195/55R16 91H - 3PMSF

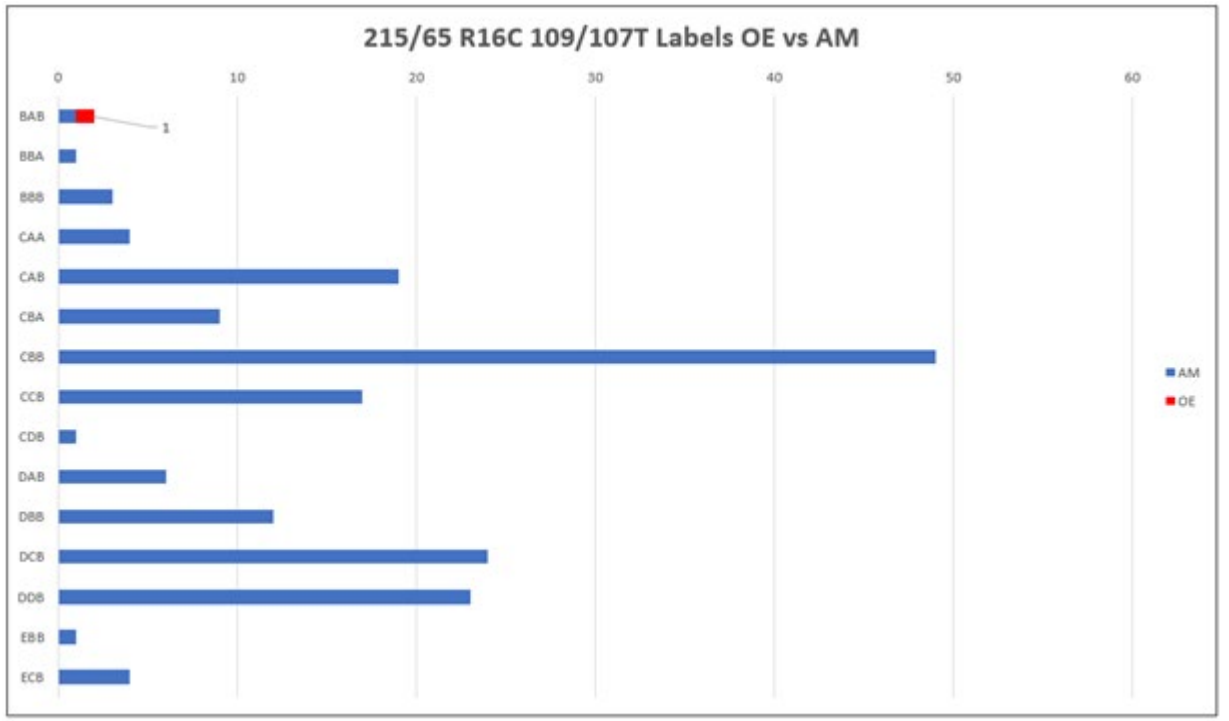
[1] Label order (ex. ABA): Rolling Resistance / Wet Grip / External Rolling Noise

WP2 – EPREL TYRE DATABASE ANALYSIS

- Analysis Results – C2 Tyres:
  - OE vs Aftermarket Tyre Labels – example:



215/65R16C 109/107T - Summer



215/65R16C 109/107T – 3PMSF

WP2 – EPREL TYRE DATABASE ANALYSIS

- C1 and C2 Tyre Label Analysis Conclusions:
  - OE tyres among the best tyre label values.
  - Aftermarket tyres available with same or higher label values than OE tyres for the same size.
  - Due to time and resource constraints, search for OE tyre label information on OEM websites not exhaustive → Some label references considered as Aftermarket tyres may be unidentified OE tyre.
  - Best label values for 3PMSF tyre lower than for Summer (non 3PMSF) tyre of the same size.
  - Most frequent label values similar between Summer (non 3PMSF) and 3PMSF tyres of the same size.
  - New Rolling Resistance and Wet Grip regulatory limits introduced with UNR117 series 4 will lead to the removal of all tyres with the lowest label values: whole of class E and part of classes C and D, depending on the tyre class (C1 and C2) and category of use (3PMSF / non 3PMSF) considered.

WP3 – REAL LIFE TESTING

- Objectives:
  - Quantify differences in tyre wear / abrasion in relation to:
    - Vehicle type: ICE vs BEV,
    - Tyre type: OE vs aftermarket tyres with different label values.
- Vehicles selection:
  - Scope: BEV & ICE vehicles from same model platform,
  - Vehicles: 1 x BMW iX1 xDrive (BEV) vs 5 x BMW X1 (ICE).
- Tyres selection:
  - Scope: C1 summer tyres,
  - Tyre size: 245/45R19 102 Y,
  - Tyre labels (rolling resistance / wet grip):
    - AA (aftermarket, best label combination available),
    - AB (OE homologated),
    - BA (OE homologated),
    - CA (aftermarket, best-selling based on analysis of French tyre distributors websites),
    - DB (aftermarket, worst label combination available),
  - Tyres tested before tyre wear test to check wet grip and rolling noise label values.

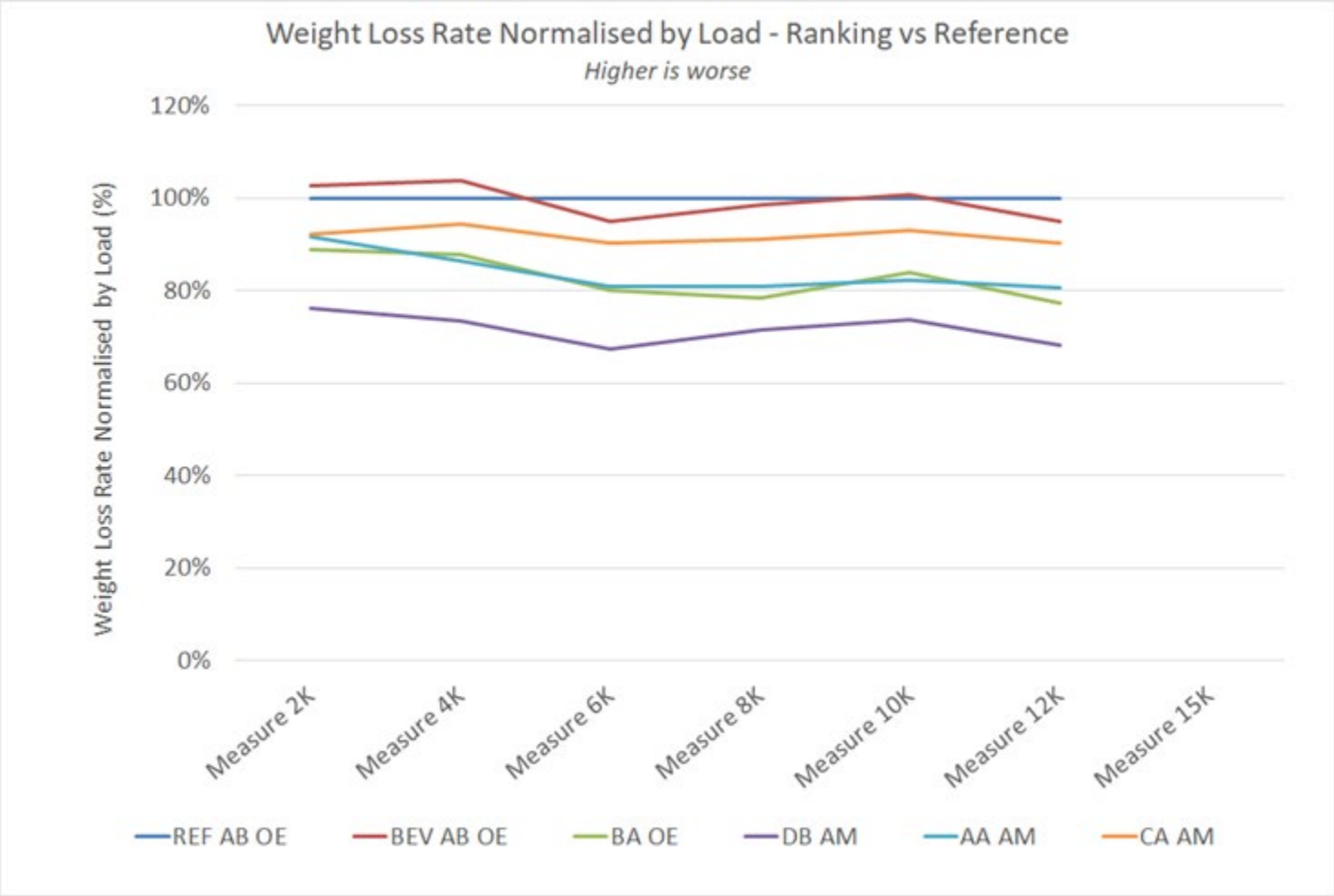
WP3 – REAL LIFE TESTING

- Circuit:
  - Specifications as close as possible to TADG-ORV Test Method proposal,
  - Open road circuit around UTAC Mortefontaine site (Northern France),
  - Compatible with BEV range & charging constraints.
- Test Method:
  - Test procedure as close as possible to TA DG-ORV Test Method proposal,
  - Main differences with TADG-ORV Test Method proposal:
    - 1 double convoy: 3 + 3 vehicles mixing ICE and BEV to limit test time & cost,
    - Reference (REF): BMW X1 (ICE) fitted with AB OE homologated Tyre,
    - Total running distance: 15,000km (8 weeks),
    - Measurement parameters: tyre tread depth and mass loss.
- Timing:
  - Test start: beginning of July 2023,
  - Test end: end of August 2023.

Circuit characteristics	
Length (km)	390
City (km / %)	59 km / 15 %
Road (km / %)	195 km / 50 %
Highway (km / %)	137 km / 35 %
Average speed (km/h)	93,13
Standard deviation speed	32
Standard deviation longi accel (m/s^2)	0,68
Standard deviation lat accel (m/s^2)	0,87

WP3 – REAL LIFE TESTING

- Testing Progress – Weight Loss Rate after 12000km out of 15000km:

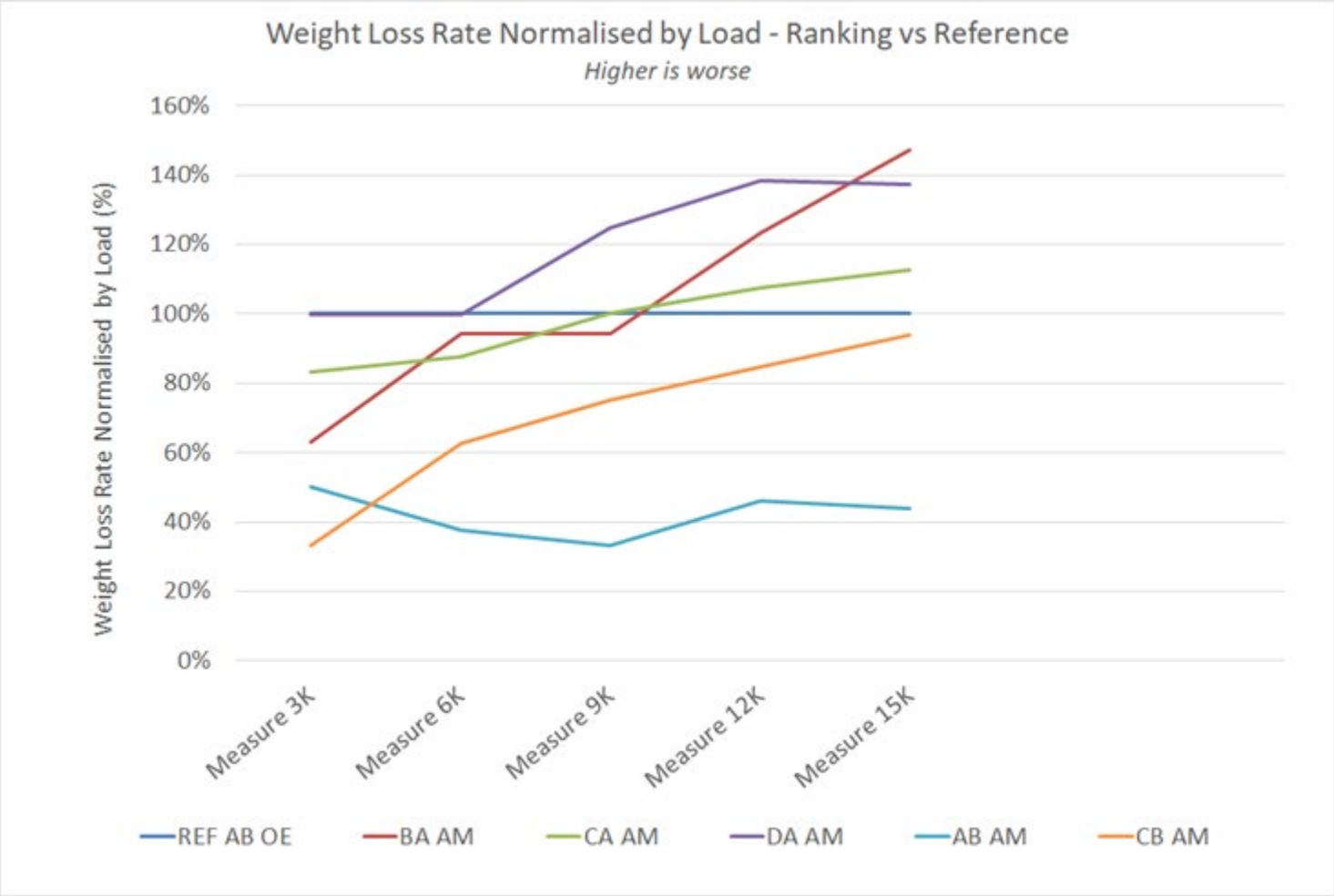


Comments on testing data currently available:

- **Testing still ongoing: full testing results analysis not started**,
- Vehicle weight influence on weight loss rate observed → Change in test results when normalised by vehicle load,
- Similar weight loss rate between ICE and BEV when tested in same convoy and results normalised by vehicle weight.

WP3 – REAL LIFE TESTING

- Previous UTAC study for ACEA (2021) – Weight Loss Rate after 15000km:

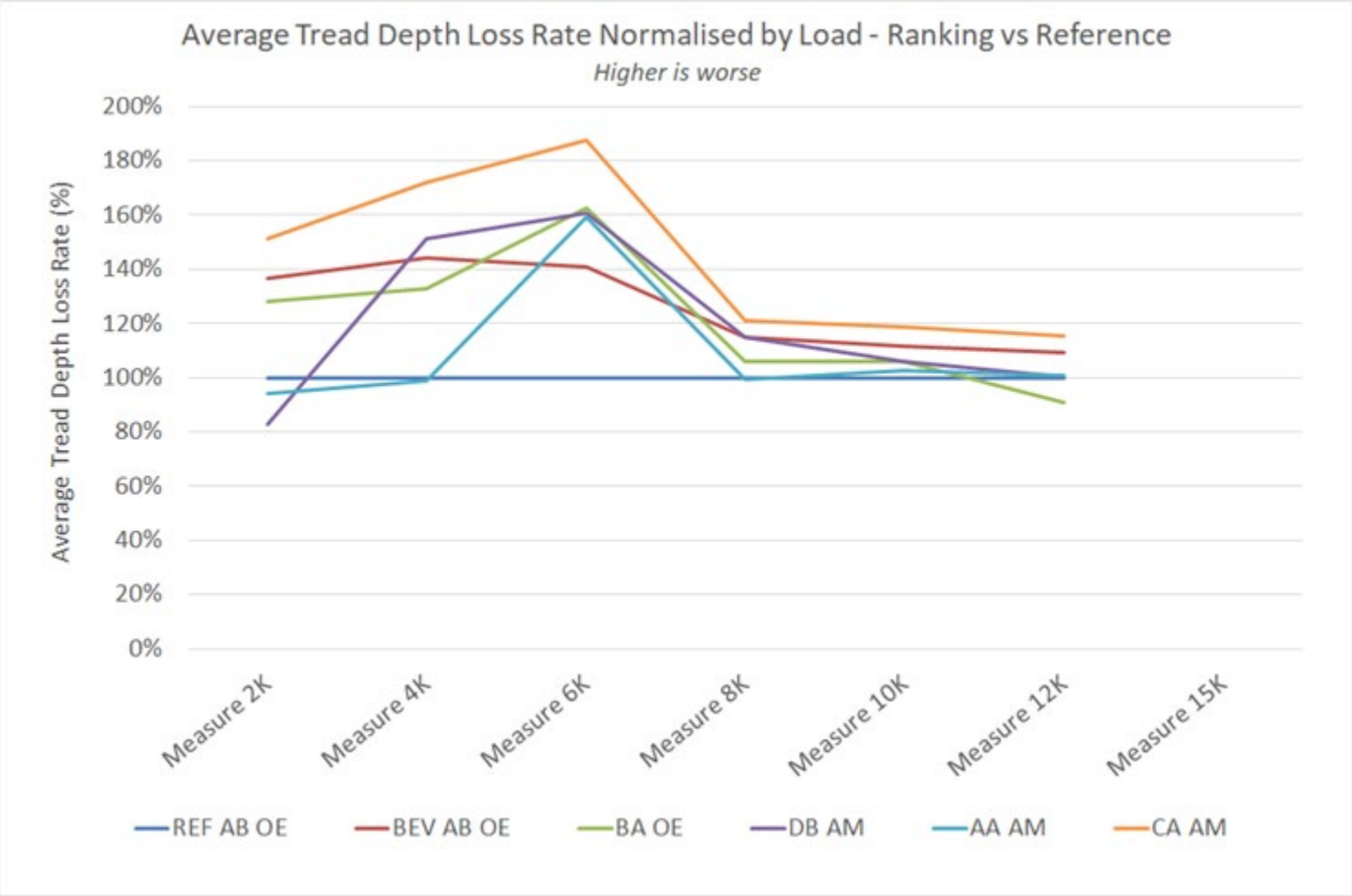


Comments on previous test data vs current testing:

- Different circuit (less severe),
- Different test method,
- Different test vehicles: Peugeot 308,
- Different test tyres: 205/55R16 91V.

WP3 – REAL LIFE TESTING

- Testing Progress – Average Tread Depth Loss Rate after 12000km out of 15000km:



Comments on testing data currently available:

- **Testing still ongoing: full testing results analysis not started**,
- Tread Depth Loss Rate expressed as % vs New,
- Vehicle weight influence on tread depth loss rate observed → Change in test results when normalised by vehicle load,
- Longer test distance required to get stabilized tread depth loss rate compared to weight loss rate.

NEXT STEPS

- WP3 – Real Life Testing:
  - Testing to be completed end of August 2023.

- WP4 – Test Results Analysis:
  - Analysis to be completed mid-September 2023.
  - Conclusions to be included in study final report presentation to GRPE 90th session / GRBP 79th session.

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