

In-Service Conformity & Boundary Conditions in EU Real-Driving Emissions Legislation

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Association for Emissions Control by Catalyst (AECC AISBL)

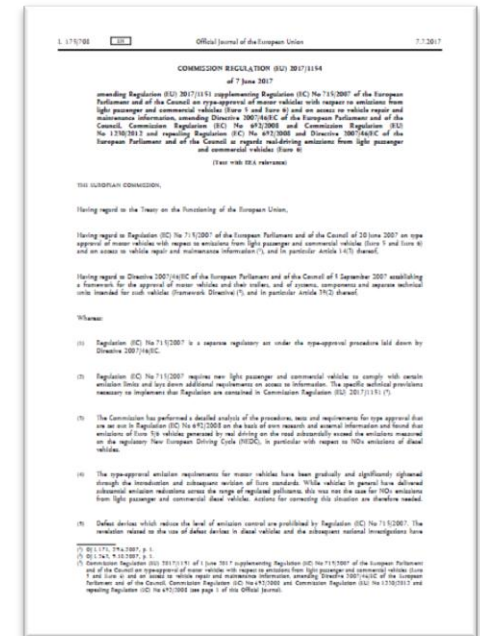
AECC members : European Emissions Control companies



- Exhaust emissions control technologies for original equipment, retrofit and aftermarket for all new cars, commercial vehicles, motorcycles and non-road mobile machinery

Euro 6 RDE entered into force as of 1 September 2017

- 3rd RDE legislation (EU) 2017/1154 published on 7 July 2017
- RDE legislation contains list of parameters to characterise normal driving
 - RDE route criteria
 - Ambient conditions
 - Dynamic boundary conditions
 - RDE CO₂ emissions within range of WLTP reference
- Not-to-Exceed (NTE) limit = Euro 6 limit x Conformity Factor (CF)
 - Conformity Factor = 1 + error margin for Portable Emissions Measurement Systems (PEMS)
 - Error margin for NO_x (as of 1 January 2020) and PN (as of 1 September 2017) set equal to 0.5
 - Error margin to be reviewed annually by European Commission
- NTE limit applies to total RDE trip and also urban part
- PEMS measurement results post-processed with RDE evaluation tools



Euro 6 RDE entered into force as of 1 September 2017

➤ 4th RDE act being developed - updated elements tabled at TCMV meeting on 07 September 2017



EUROPEAN COMMISSION
Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
Industrial Transformation and Advanced Value Chains
Automotive and Mobility Industries

Brussels, 05/09/2017
GROW.C.4/PD

Background note on RDE4

Updated elements of the 4th RDE act

Following the intense work of the RDE-LDV working group during the first half of 2017, the 4th RDE act is expected to deal with the following main elements:

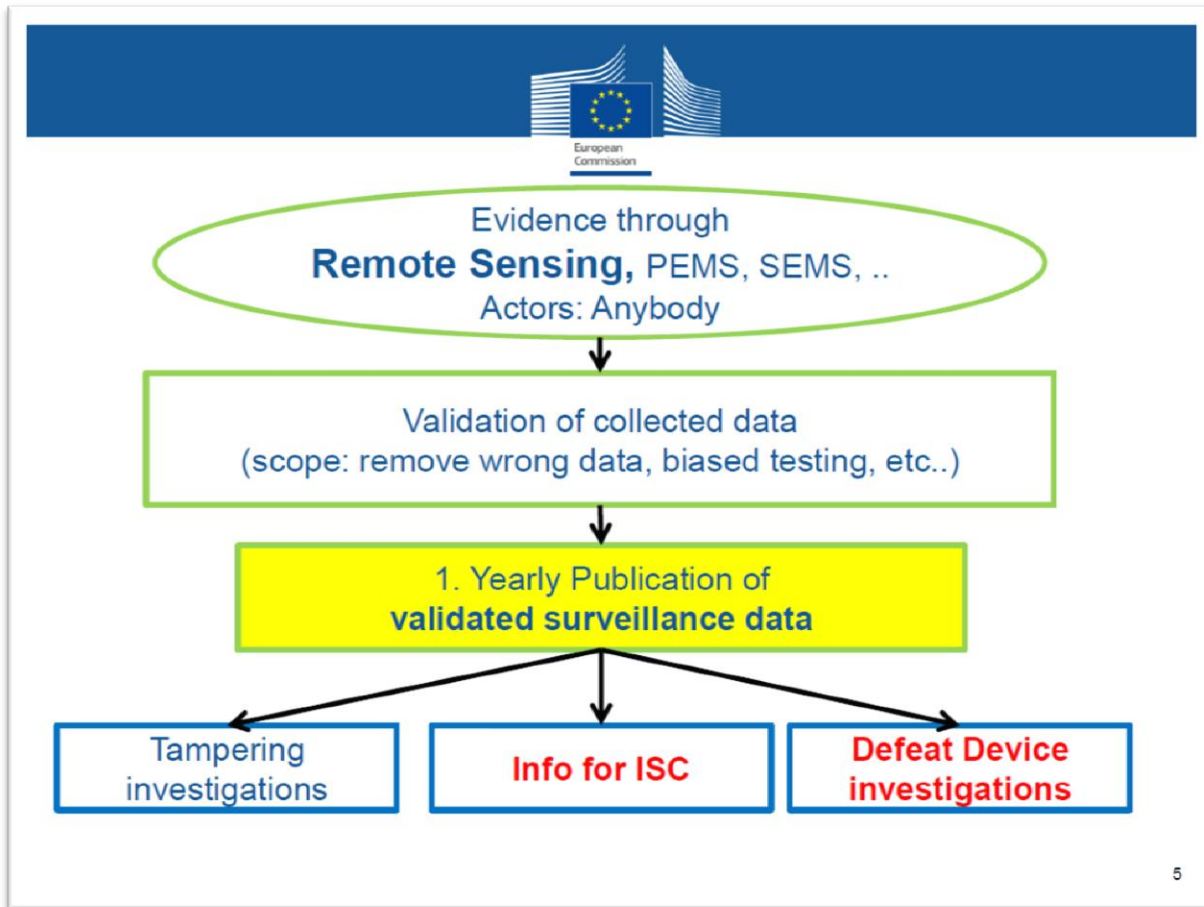
- A. **A redesigned ISC procedure**, including WLTP and RDE testing and introducing the possibility to take into account independent testing by third parties
- B. **LCVs, multistage and special purpose vehicles**
- C. **Influence of fuel on PN emissions**
- D. Review of the need for a more representative **testing method for hybrid vehicles**
- E. **Review of the uncertainty margin** for NOx.
- F. **Review of the evaluation methods** (CLEAR, EMROAD and new proposals)

Furthermore a PEMS guidance and Q&A document are being prepared.

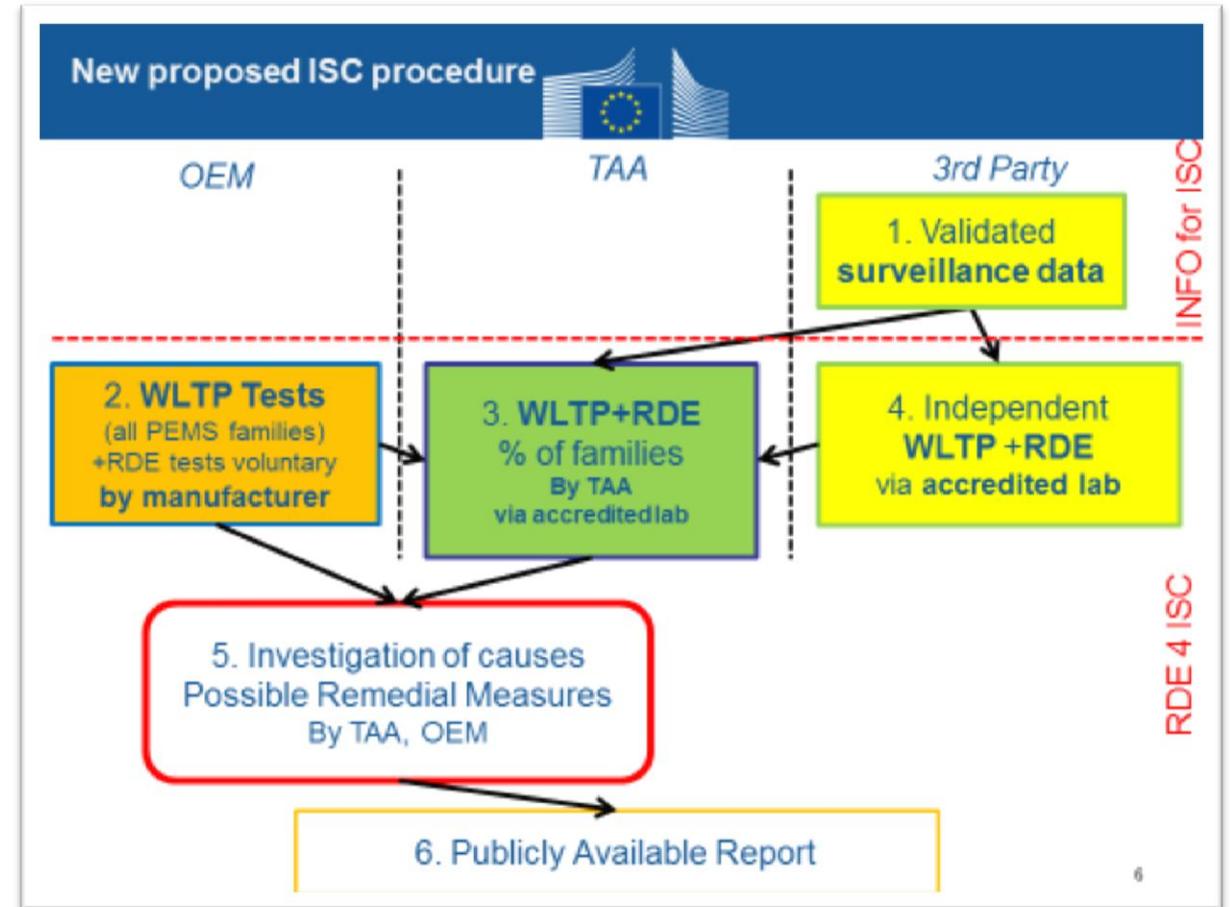
A. New ISC procedure
Reflecting the RDE testing in the ISC scheme will require it to be completely redesigned. This is due to the much longer time needed for testing a vehicle with both the WLTP and RDE procedures.

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➤ Details of In-Service Conformity (ISC) and market surveillance to be defined within RDE4



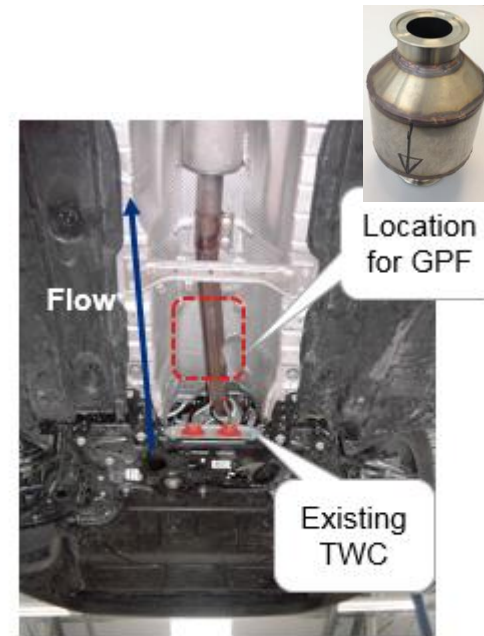
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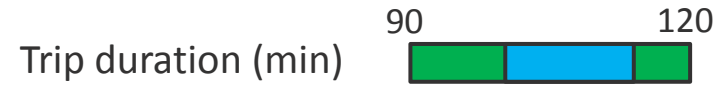
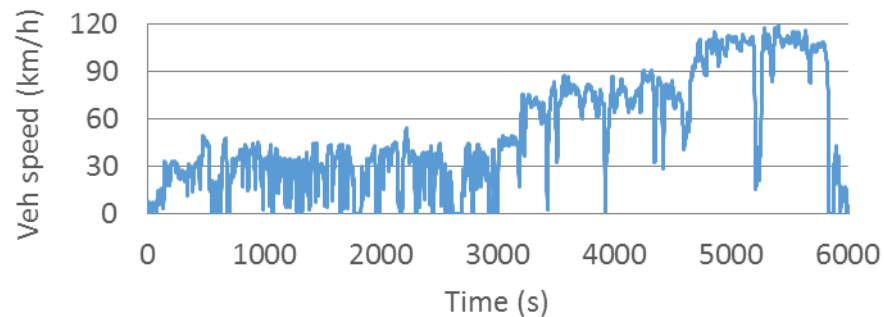
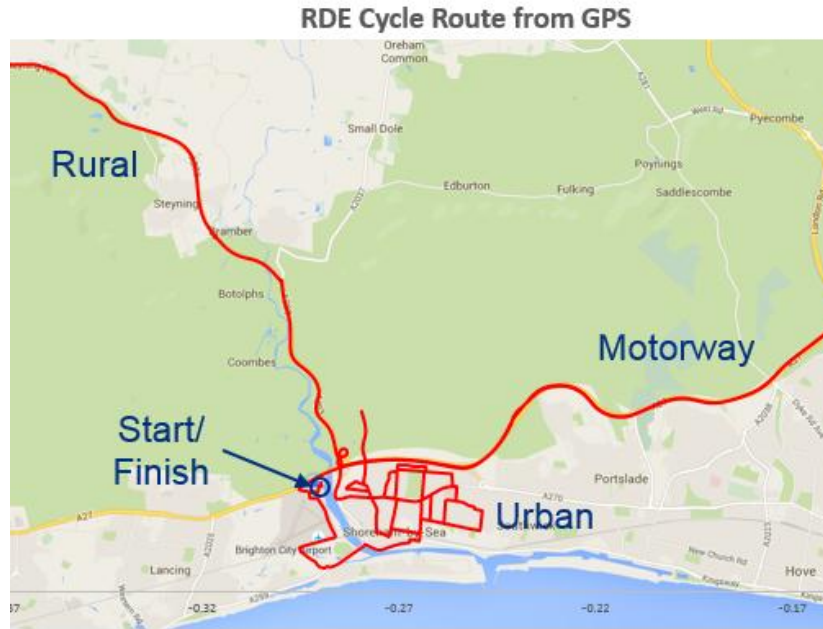
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AECC GDI RDE test programme

- Objective: investigate NO_x & PN RDE of Gasoline Direct Injection (GDI) vehicle without and with Gasoline Particulate Filter (GPF)
- Vehicle
 - C-segment, 1.5l class engine
 - Rental vehicle, Euro 6b type approved
 - Original configuration w/o GPF
 - Add coated GPF demonstrator underfloor
- HORIBA PEMS equipment
 - Gaseous PEMS (CO₂, CO, NO_x)
 - PEMS-PN demo unit



RDE route is within the RDE requirements



Distance share (%)
(>16 km)

urban (<60km/h)



rural (>60 & <90km/h)



motorway (>90km/h)



Urban requirements

Average speed (km/h)

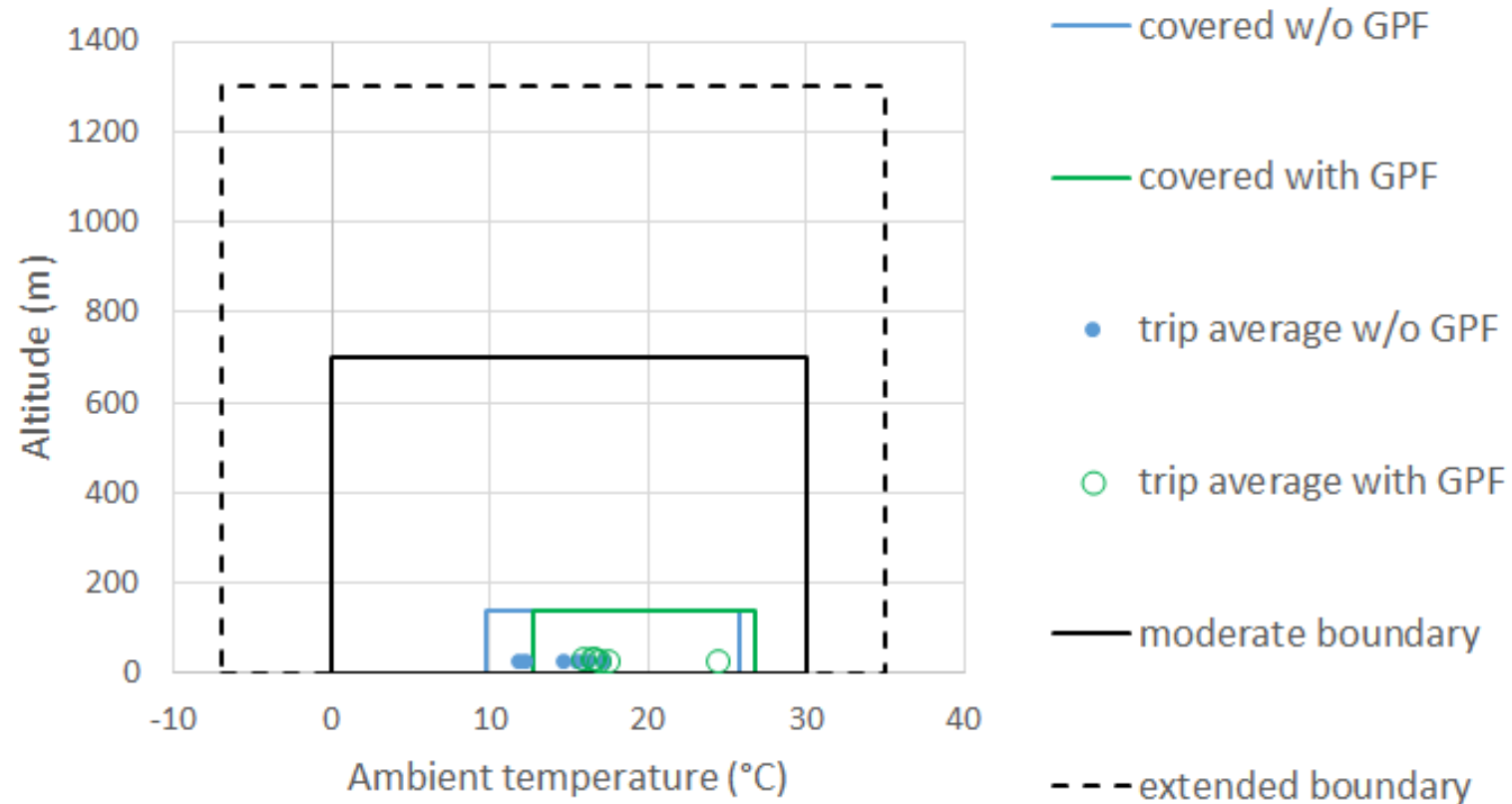


Time share of stops (%)

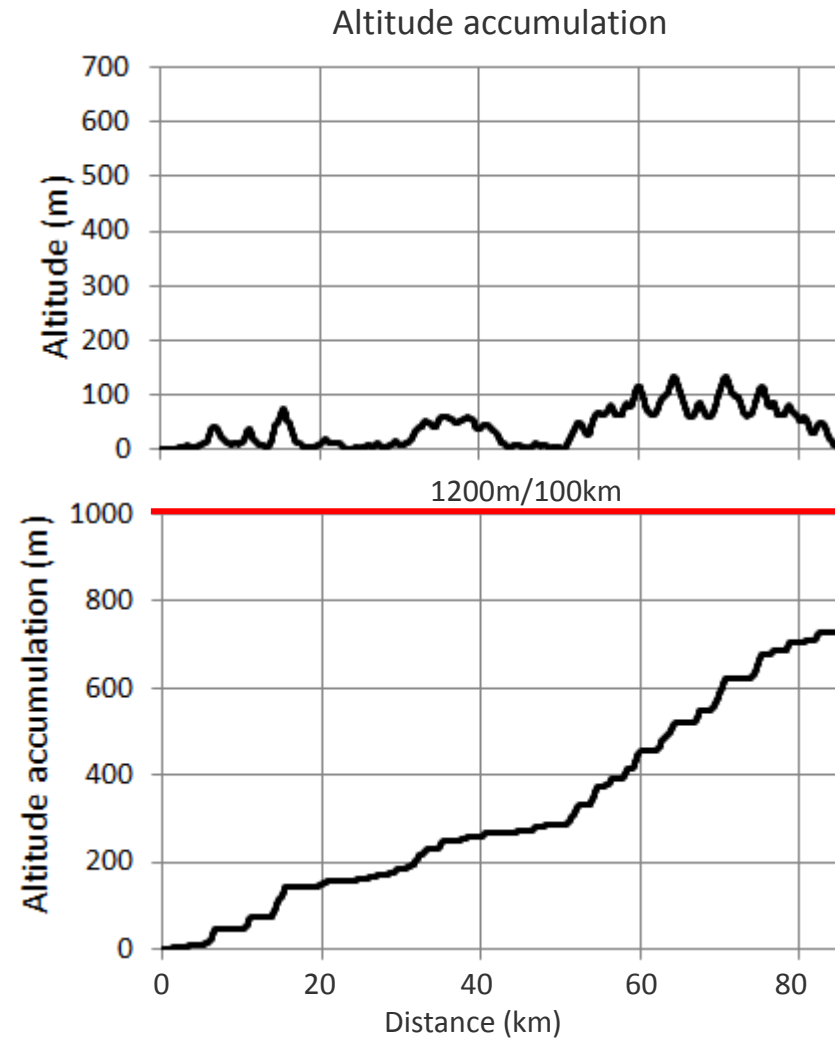
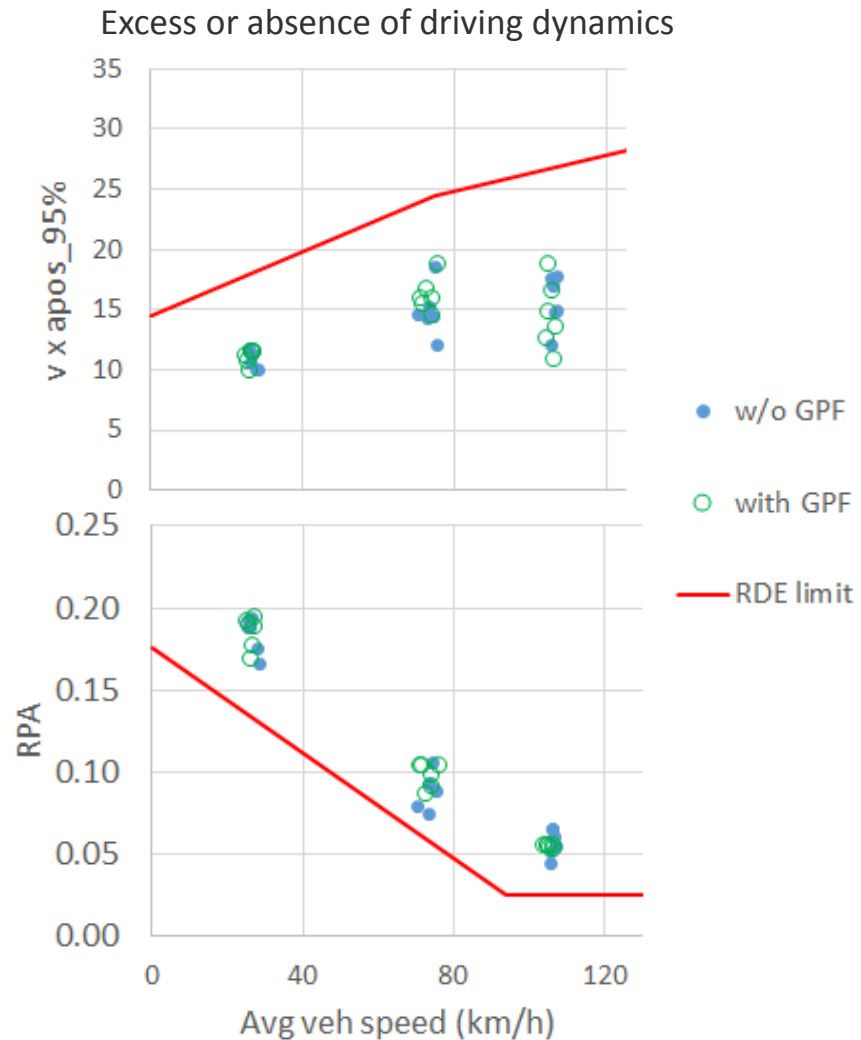


■ Allowable tolerance ■ AECC-Concawe tests

Measured data within the moderate environmental boundaries

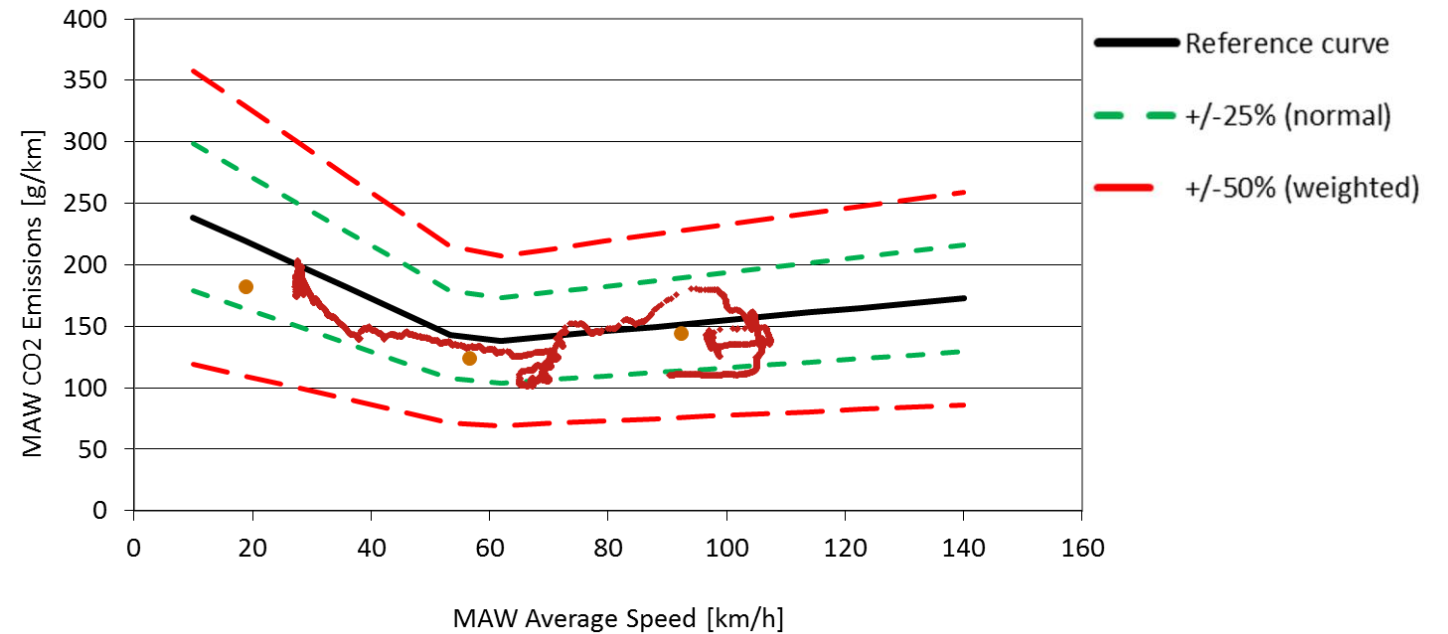
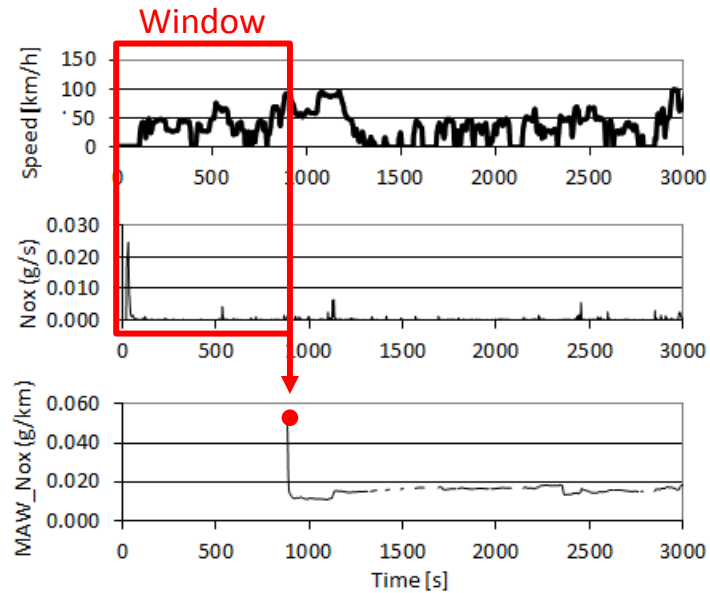


Measured data within the dynamic boundaries

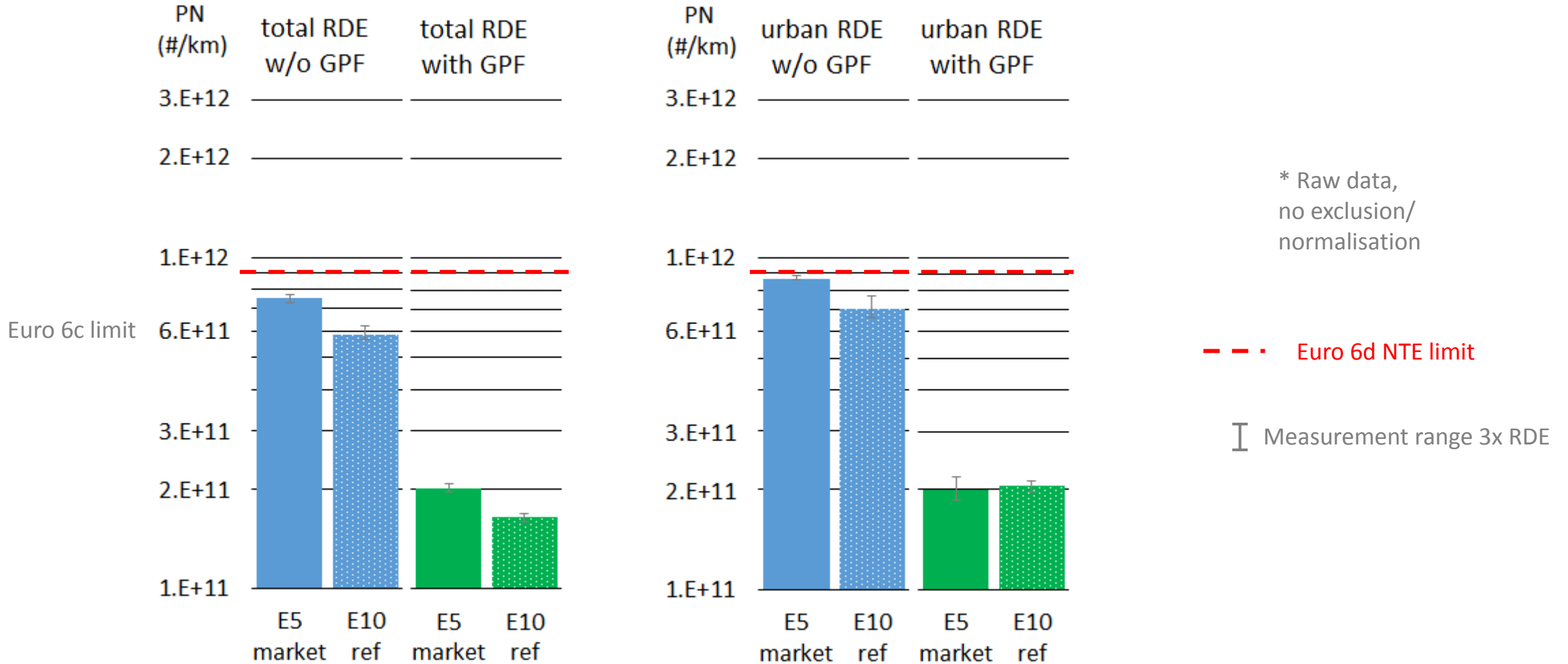


Measured data within $\pm 25\%$ of WLTC test

Visualised with Moving Average Window (MAW) post-processing approach (EMROAD)



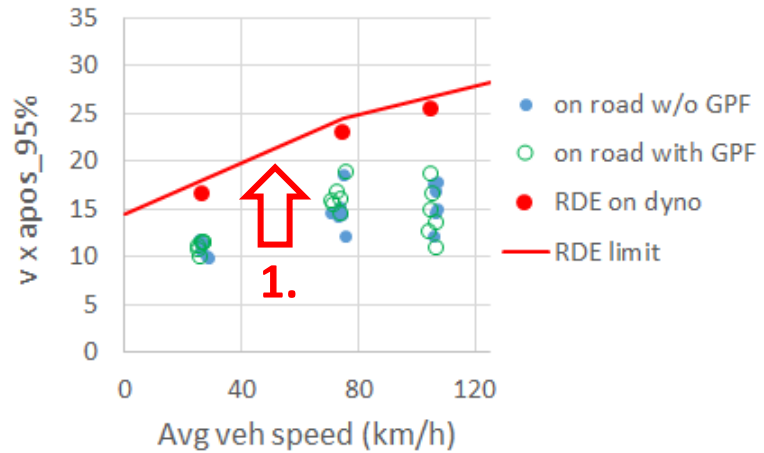
All on-road PN results with GPF are below Euro 6d NTE limit



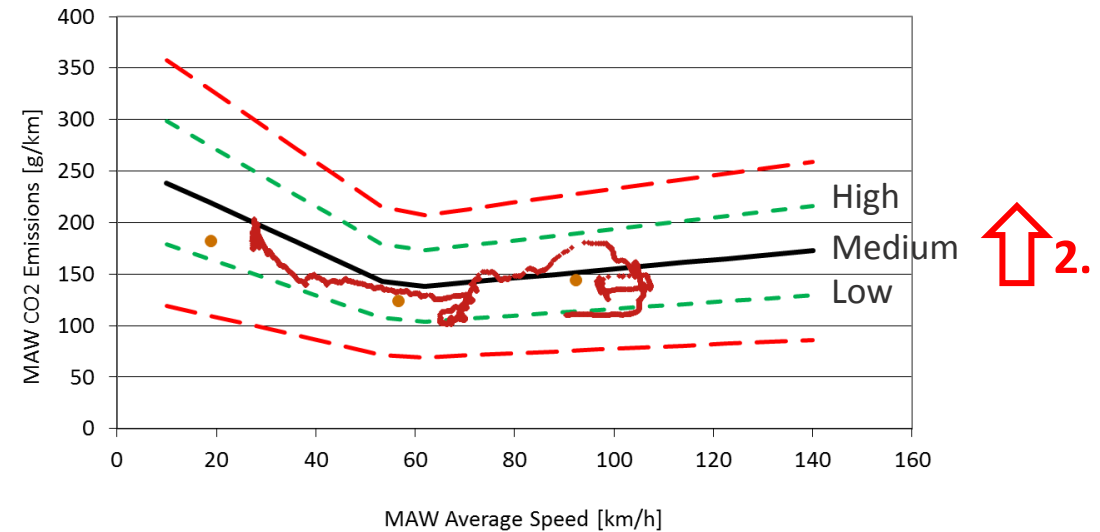
Impact of RDE boundaries tested on the chassis dyno

Severitised RDE testing (SRDE) in the lab

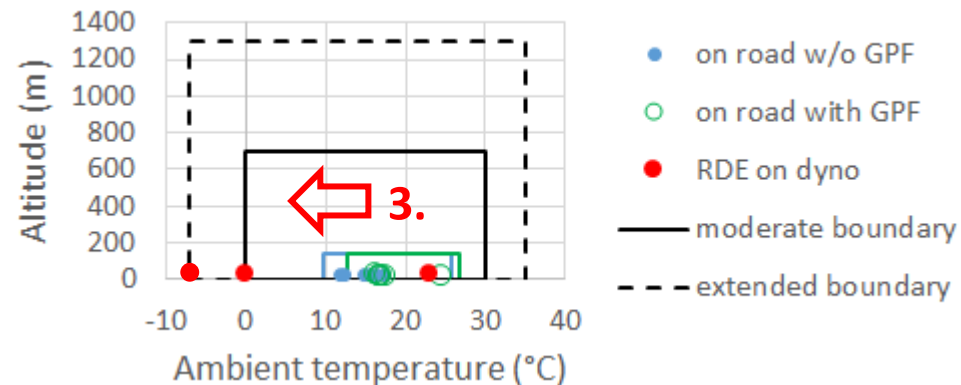
1. Change accelerations



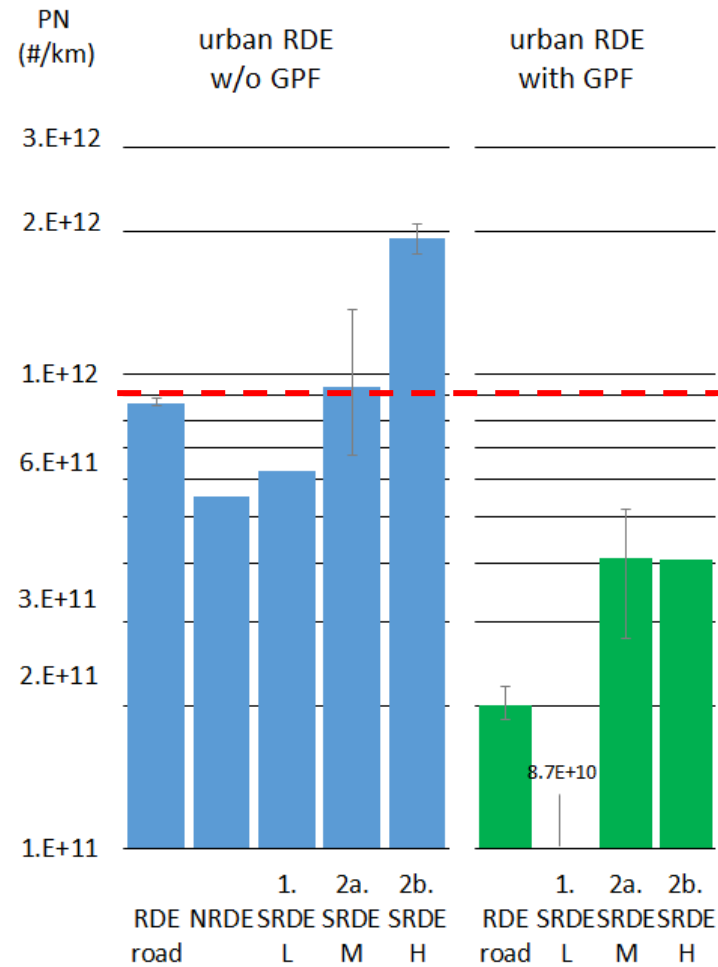
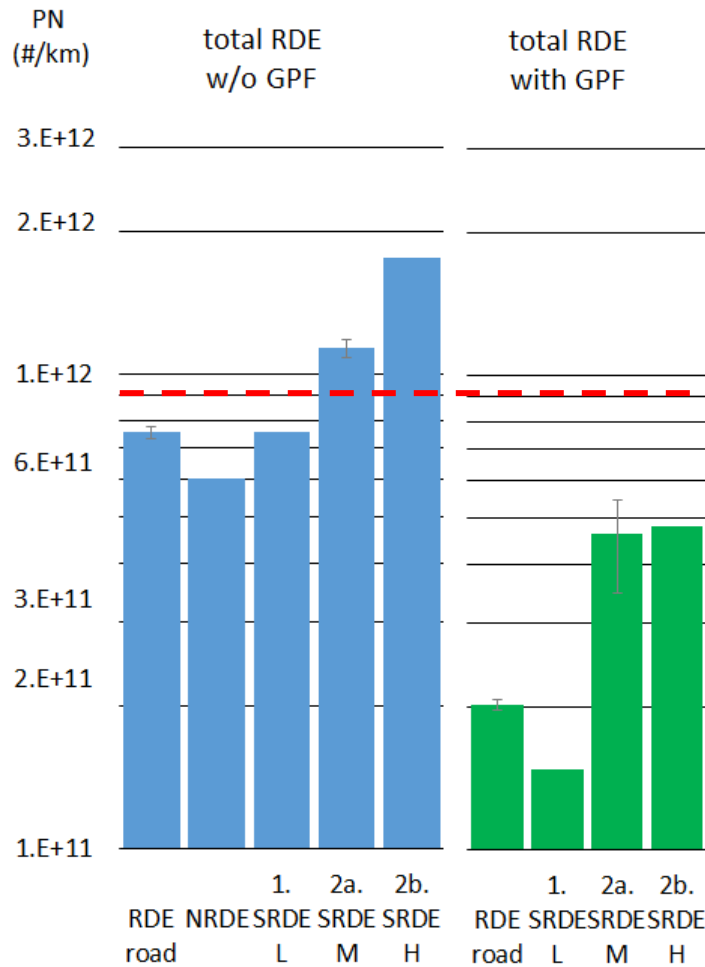
2. Change dyno load



3. Change ambient temperature



Severitised RDE PN with GPF stays below Euro 6d NTE limit



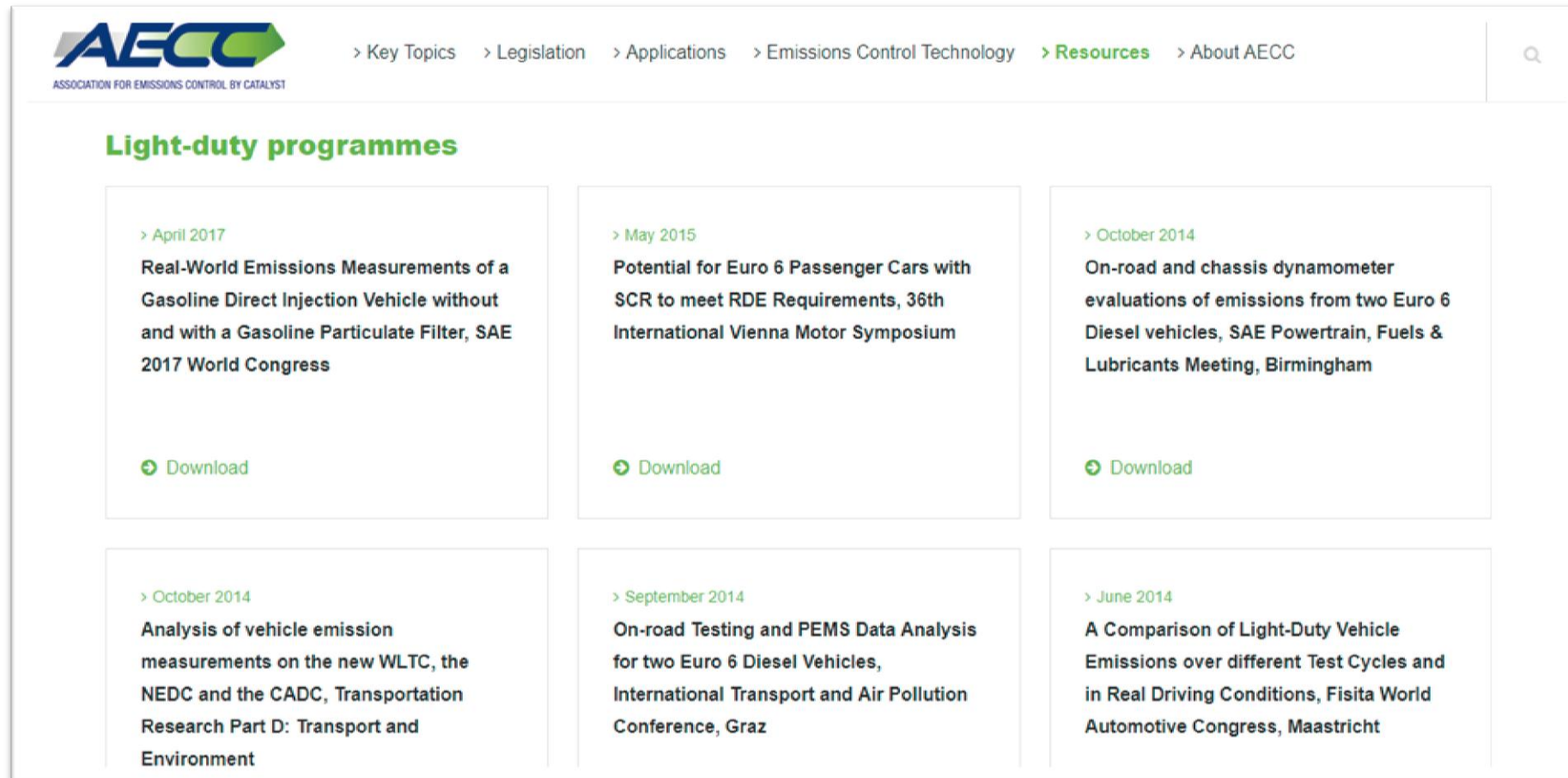
* Raw data,
no exclusion/
normalisation

--- Euro 6d NTE limit

I Measurement range
repeated tests

AECC experience with RDE testing in Europe

All AECC projects data at <http://www.aecc.eu/resources/scientific-publications/>



The screenshot displays the AECC website's 'Resources' page, specifically the 'Light-duty programmes' section. The page features a navigation menu at the top with links for 'Key Topics', 'Legislation', 'Applications', 'Emissions Control Technology', 'Resources' (highlighted), and 'About AECC'. A search icon is located in the top right corner. The main content area is titled 'Light-duty programmes' and contains six publication cards arranged in a 2x3 grid. Each card includes a date, a title, and a 'Download' button.

Date	Title	Download
> April 2017	Real-World Emissions Measurements of a Gasoline Direct Injection Vehicle without and with a Gasoline Particulate Filter, SAE 2017 World Congress	Download
> May 2015	Potential for Euro 6 Passenger Cars with SCR to meet RDE Requirements, 36th International Vienna Motor Symposium	Download
> October 2014	On-road and chassis dynamometer evaluations of emissions from two Euro 6 Diesel vehicles, SAE Powertrain, Fuels & Lubricants Meeting, Birmingham	Download
> October 2014	Analysis of vehicle emission measurements on the new WLTC, the NEDC and the CADC, Transportation Research Part D: Transport and Environment	
> September 2014	On-road Testing and PEMS Data Analysis for two Euro 6 Diesel Vehicles, International Transport and Air Pollution Conference, Graz	
> June 2014	A Comparison of Light-Duty Vehicle Emissions over different Test Cycles and in Real Driving Conditions, Fisita World Automotive Congress, Maastricht	

THANK YOU!

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