

REMOTE SENSING RDE: ITS, University of Leeds

UK urban Air Quality exceedance areas: **2007 – present**

> 1 million pass-by measurements



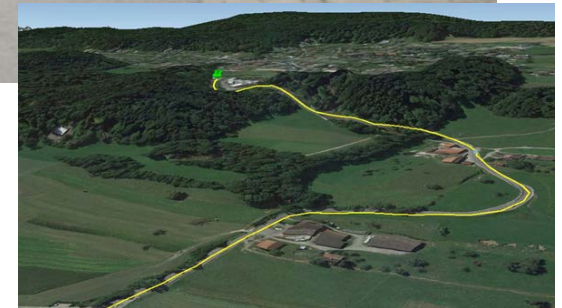
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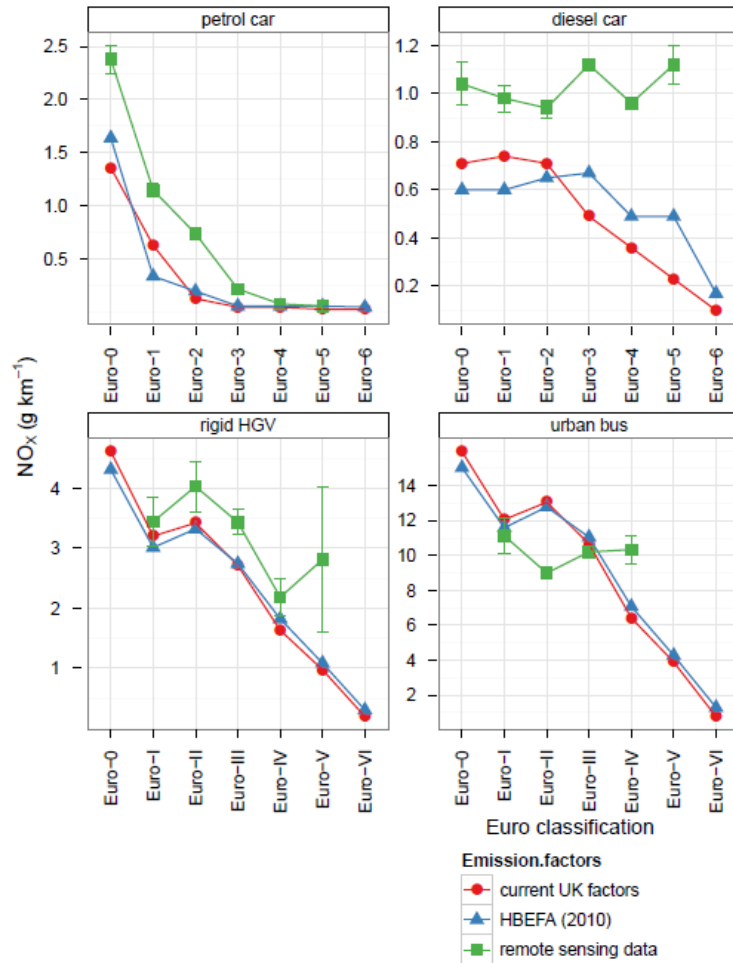
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REMOTE SENSING RDE:

AWEL, Zurich, CH: 2000, 2001, 2002..... 2016



EMISSION FACTOR ESTIMATES (2010)



$$EMISSION FACTOR (gr.km^{-1})_{RSD}$$

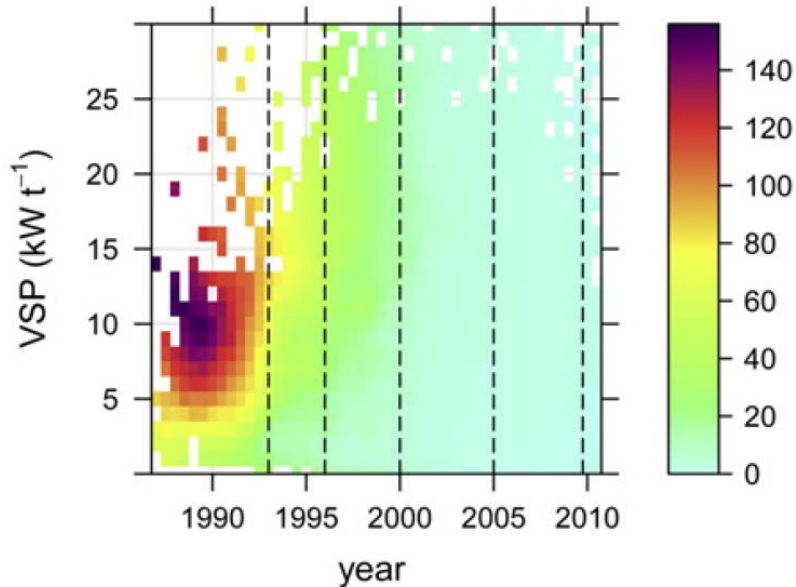
$$= \left(\frac{NO_X}{CO_2} \right)_{RSD} \times \left(\frac{CO_2}{km} \right)_{MANU}$$

$$\times (CO_2 \text{ Correction Factor})_{ICCT,2015}$$

INFLUENCE HIGH VEHICLE POWER:

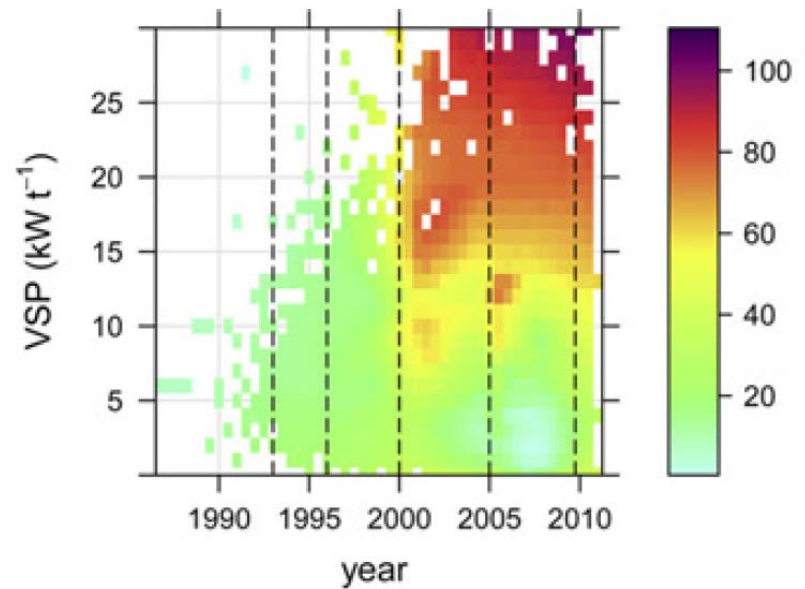
Analysis RSD NO_x/CO_2 & Vehicle Specific Power (VSP)

PETROL

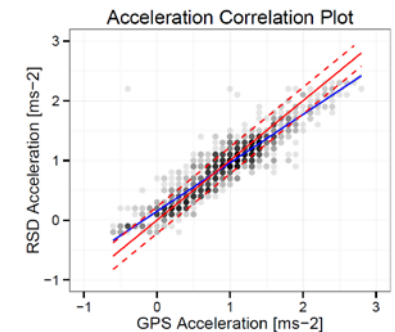
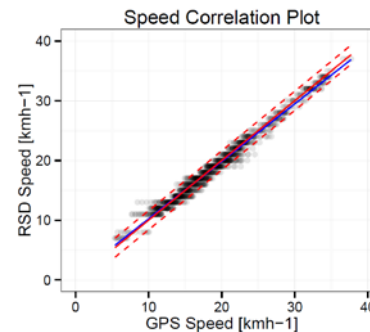


NO_x/CO_2 for petrol vehicles, $\tau=0.5$

DIESEL

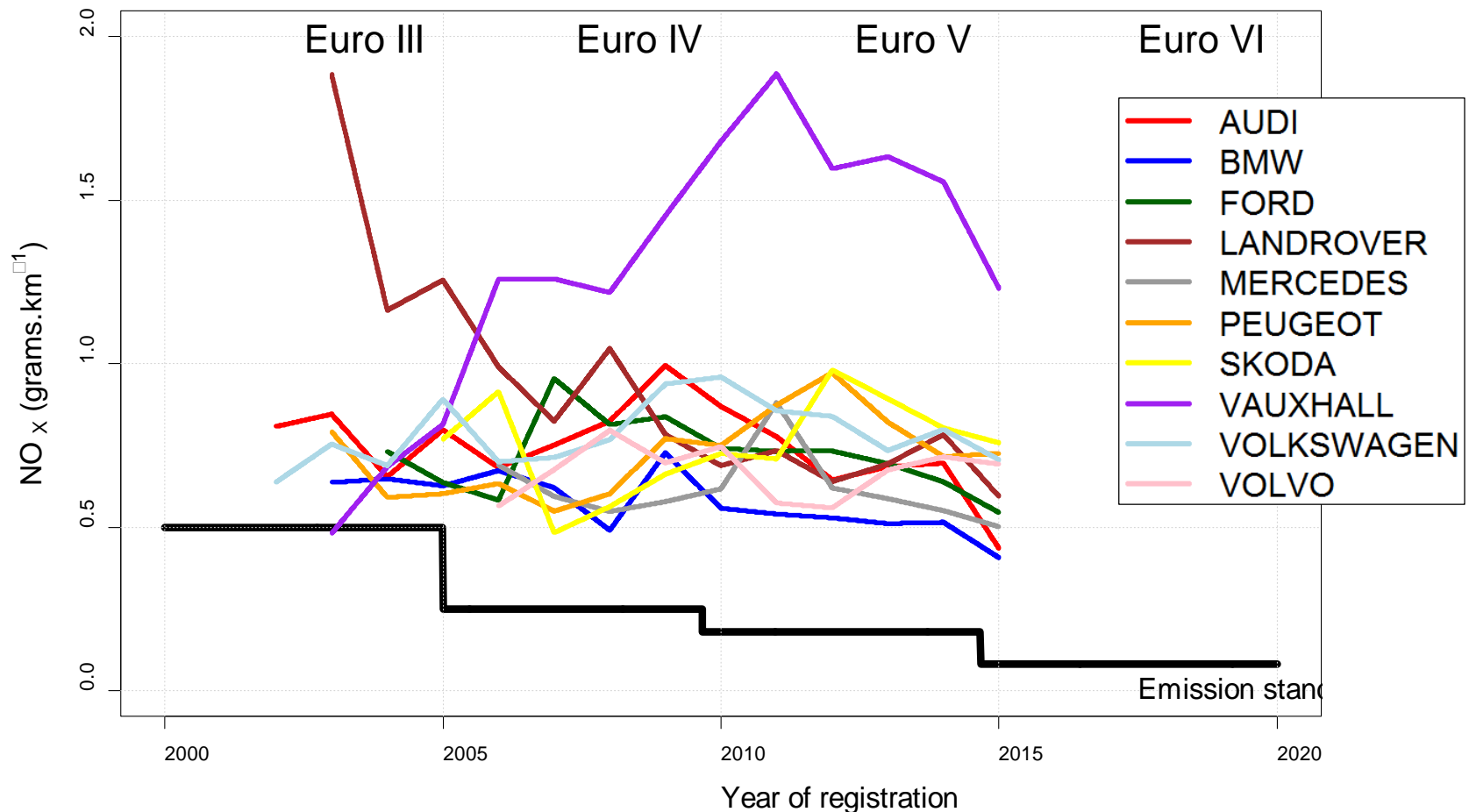


NO_x/CO_2 for diesel vehicles, $\tau=0.5$



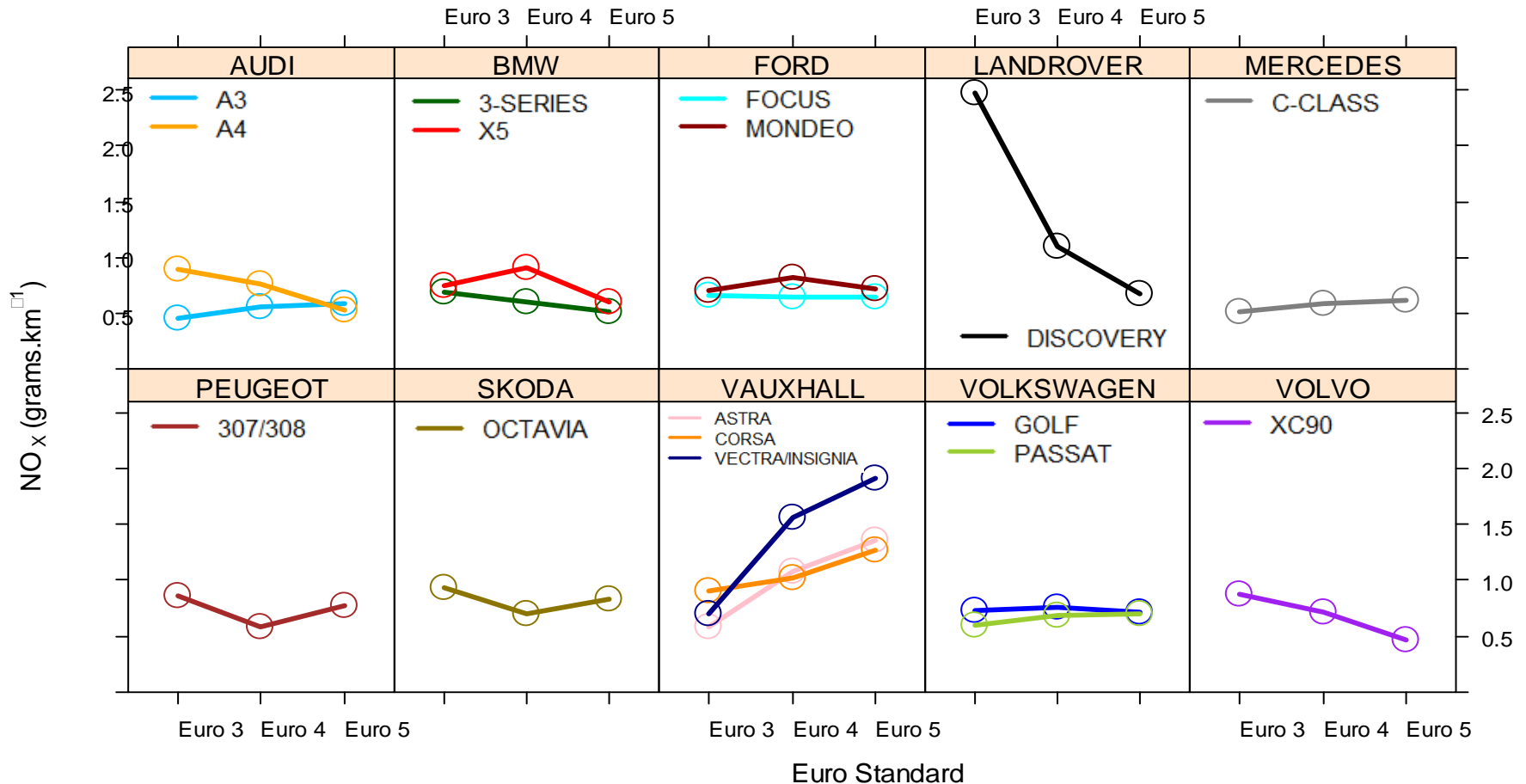
#DIESELGATE

NO_x emissions of 2.0 litre diesels by marque & Year registration
Surveys 2015: Leeds & Aberdeen, UK

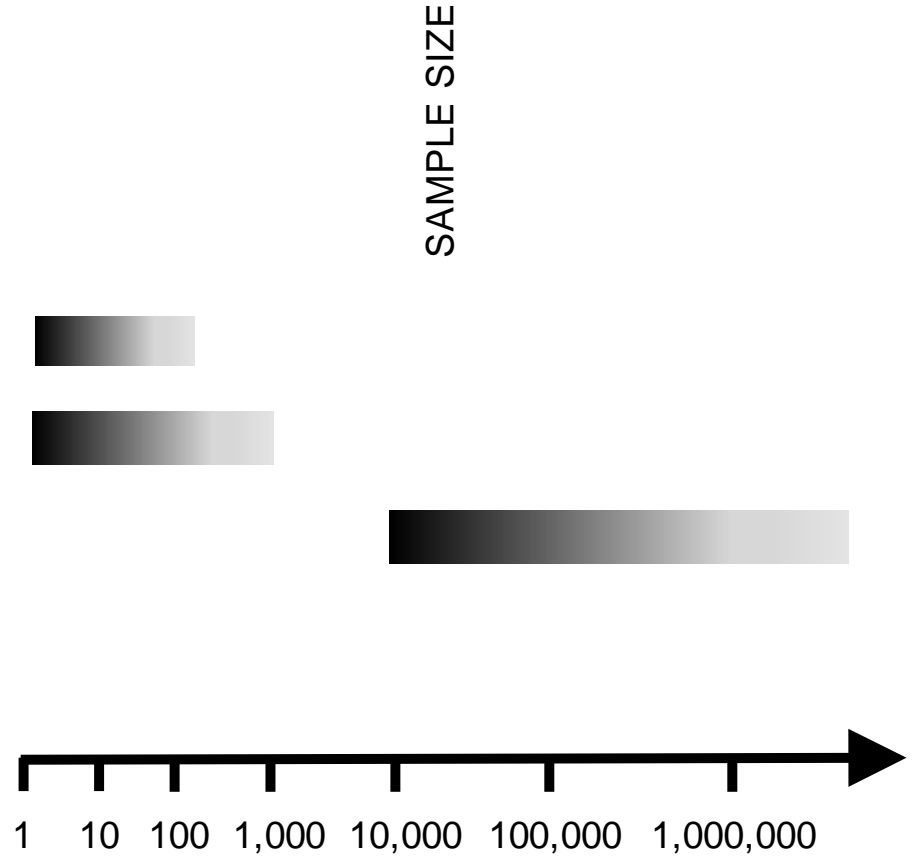


#DIESELGATE

NO_x emissions of common marques & models



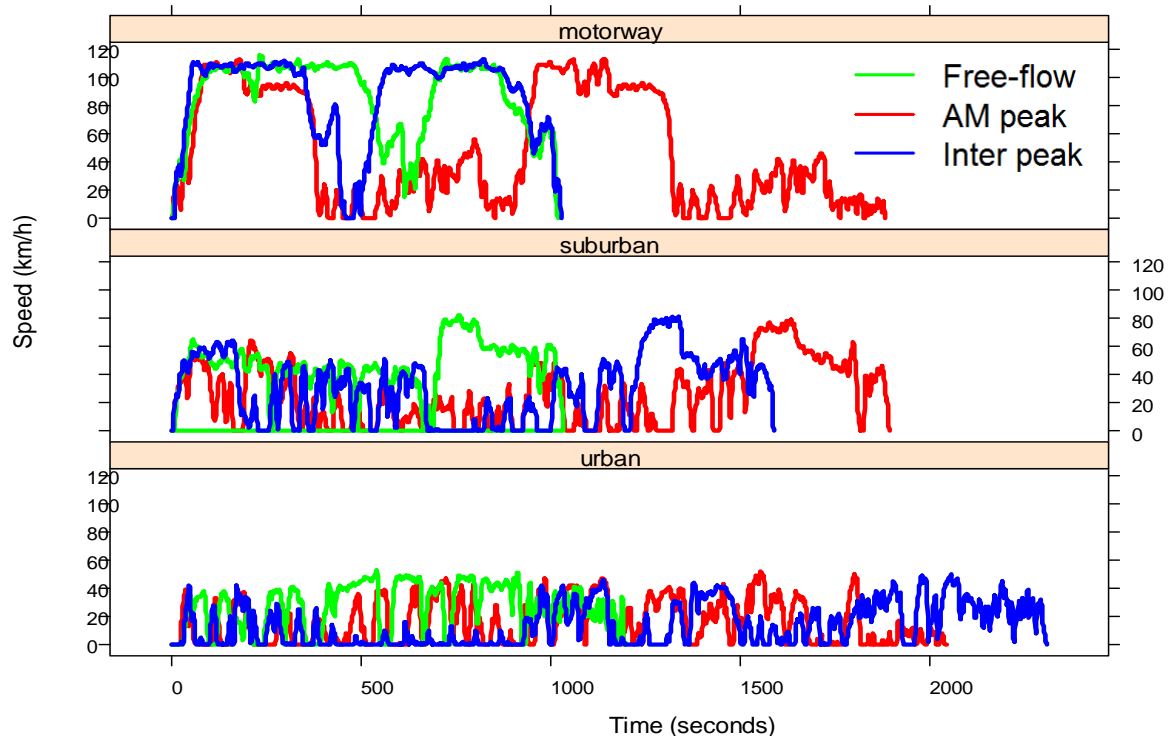
	RDE	CONTROLLED	VARIABLES e.g. Temp, Fuel	IN-SERVICE & TRENDS
LAB	✓	✓✓✓	✓	✓
PEMS	✓✓✓	✓✓	✓✓	✓
REMOTE SENSING	✓✓	✓	✓✓✓	✓✓✓



LABORATORY: *Taking the road into the Laboratory*

- Laboratory test so direct comparisons between vehicles can be made
- Transport for London (TfL) testing over a 'REAL' London Drive Cycle developed from a sample of vehicle tracking data
 - Time periods: AM peak, Inter-peak, Free-flow
 - Road types: urban, suburban, motorway (urban)

TOTAL = 140 kms



TfL EURO 6 / VI LABORATORY TESTING

12 PASSENGER CARS: tested over the entire LDC (140 kms)

- ▶ Powertrains | petrol (2), diesel (9) and petrol-HEV (1);
- ▶ Exhaust after-treatments | 3 way Cat, LNT and SCR;
- ▶ Market segments | Compact, Supermini, Small family, Family/MPV, SUV/4x4, Prestige/sports and Hybrid; and
- ▶ Marques | BMW, Fiat, Lexus, Mercedes, Peugeot, Volvo and Volkswagen.

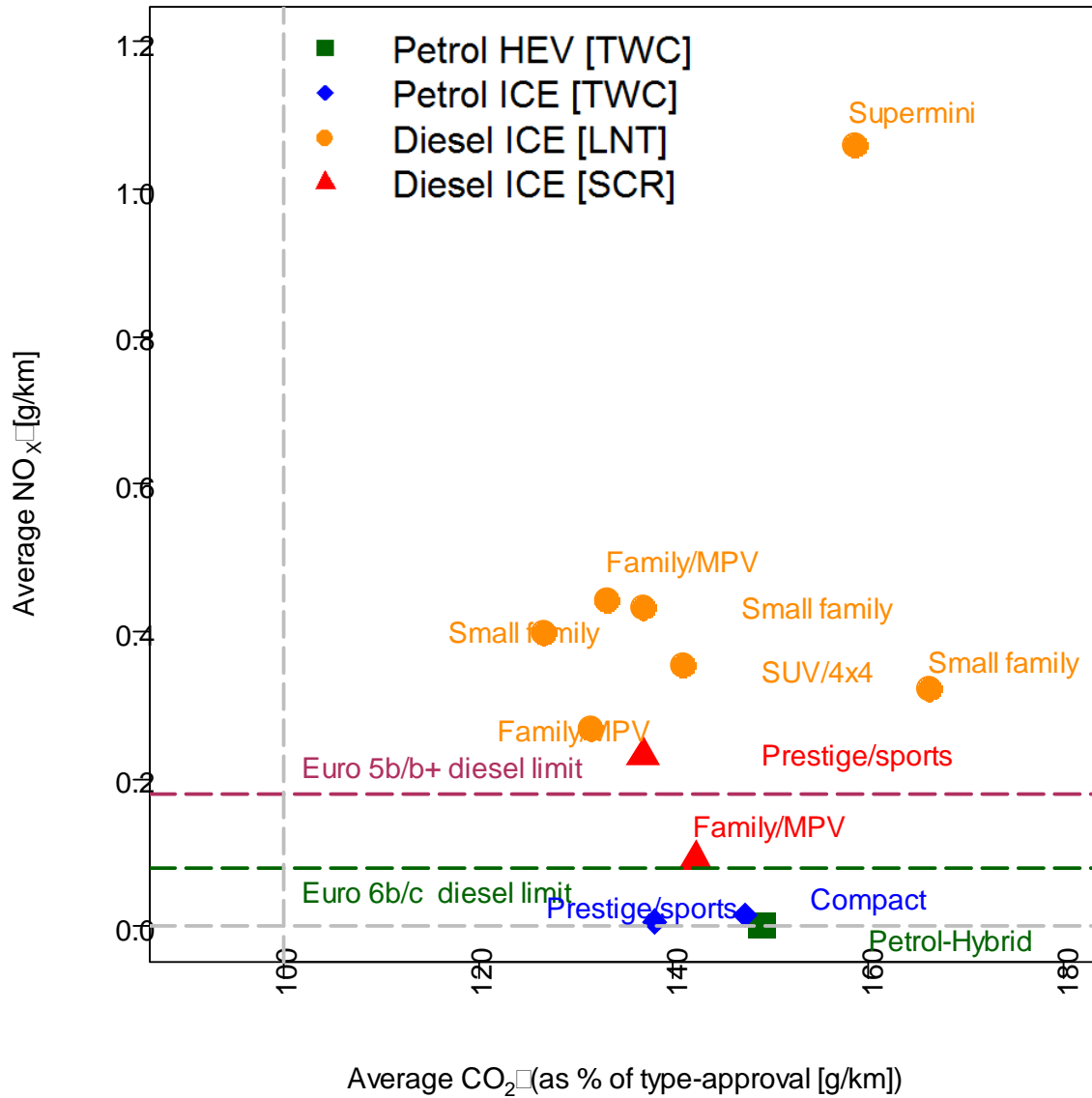
3 HEAVY-GOODS VEHICLES: tested over the suburban sub-cycles only

- ▶ Rigid HGV N2 7500kg
- ▶ Rigid HGV N3 18000kg
- ▶ Artic HGV N3 40000kg
- ▶ LADEN and UN-LADEN

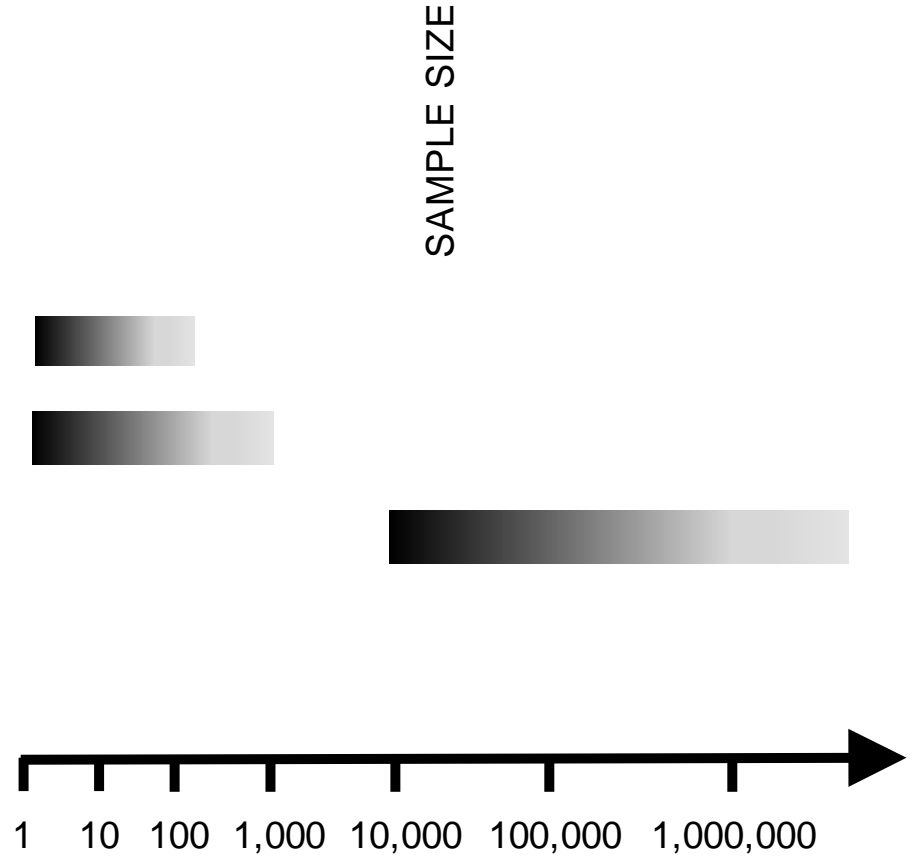


¹ Millbrook Vehicle Emission testing laboratories that meet the requirements of Directive 2007/46 EC Article 41, Section 3 and have been designated as a Category A Technical Service for Individual Vehicle Approvals (IVA).

TfL PASSENGER CAR RESULTS



	RDE	CONTROLLED	VARIABLES e.g. Temp, Fuel	IN-SERVICE & TRENDS
LAB	✓	✓✓✓	✓	✓
PEMS	✓✓✓	✓✓	✓✓	✓
REMOTE SENSING	✓✓	✓	✓✓✓	✓✓✓



Remote Sensing RDE:

OUTLOOK

- Euro 6 and Euro 6c diesel analysis
- Primary NO₂ emissions speciation
- Continuous operation → more measurements
- Data sharing (RSD workshop September)
- BIG data analysis techniques to answer research questions
e.g.
 - ▶ Screening of “clean” and “polluting” marques & models (including less common vehicles)
 - ▶ Engine “down-” & “right-” sizing
 - ▶ Influence ambient TEMP & Relative Humidity (RH)
 - ▶ In-service deterioration