

Why a new short test procedure?

- The most important air-quality related exhaust constituents ultrafine particle PN and NOx are not measured
- The free acceleration test for Diesel is used only very limited in reality - specifically with HDV
- Chip tuning: Increased maximum power or so called Eco tuning
- AdBlue Hardware and Software Emulators for deactivating the urea injection of NOx catalysts
- Defeat devices and engine protection in a wide operation range
- A significant share of Euro 6 cars, trucks and busses still have highly exceeding emissions
- OBD systems showed no errors

Abstract:

At least since the diesel gate scandal, the public has become aware of the possibilities of software engineers, and so it is not surprising that one does not trust the on-board diagnostic functions too much.

The inspection system needs reliable methods to detect, on the one hand, the emissions of motor vehicles during regular periodic inspections and, on the other hand, to detect the malfunction of the ECU's control function. Our research group at the Vienna University of Technology has taken up this topic and developed a universal short test procedure for internal combustion engines. The first results of the methodology were discussed with the European Commission.

Methodology: The procedure is similar to that exhaust gas test, which has already been carried out in Europe for several decades on internal combustion engines with gasoline engines and three-way catalytic converter. The engine is operated at idle and measured at operating temperature; a second test is performed either under load application, or at slightly increased idle speed. The unloaded idle acceleration up to maximum speed thus eliminated. In addition to the known quantities CO₂, CO, HC and O₂, the determined emission values additionally include NOx, NO₂, NO, particle number and average particle size. The values are related to the equivalent air-fuel ratio Lambda. The measuring system used is a further development of the established RDE-device OBM 5.0, which was adapted for stationary exhaust gas analysis.

Results: Related to previous presentations significantly more vehicles were investigated and statistically analyzed. The results showed predominantly good correlations between the emissions during the short test in comparison to RDE measurements. This instrument significantly upgrades the periodic inspection of motor vehicles on the road, as it reflects a real emission behavior at the tailpipe of the exhaust system and does not make use of car specific engine control data.

Distance Related Real World Emissions LDV Diesel

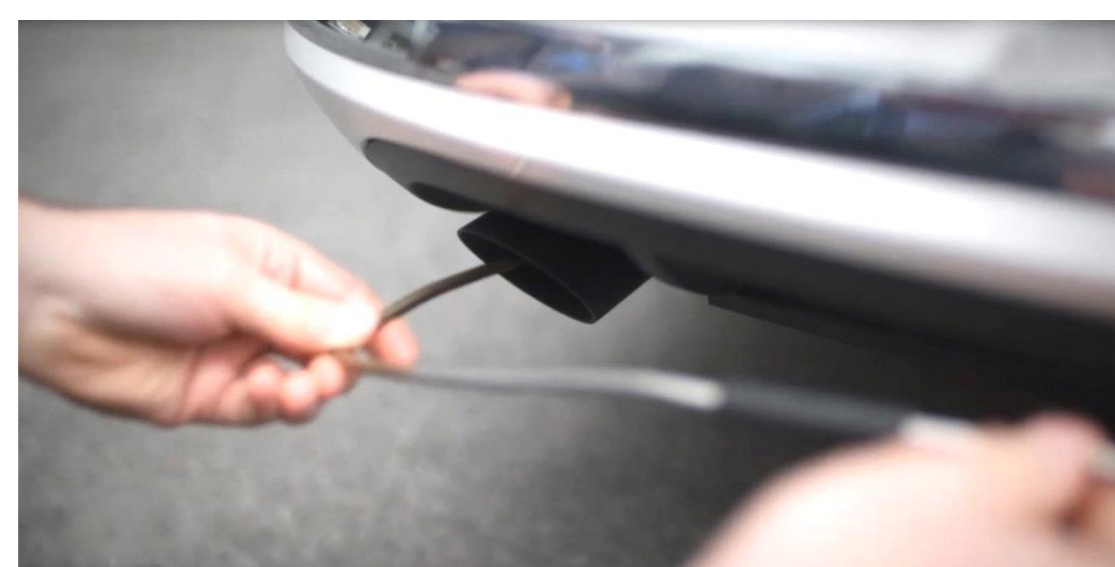
	NO _x [mg/km]	Partikel [#/km]
Euro 5	100 to 3.000	10 ⁹ to 10 ¹³
Euro 6	10 to 900	10 ⁹ to 10 ¹²

Distance Related Real World Emissions HDV Diesel

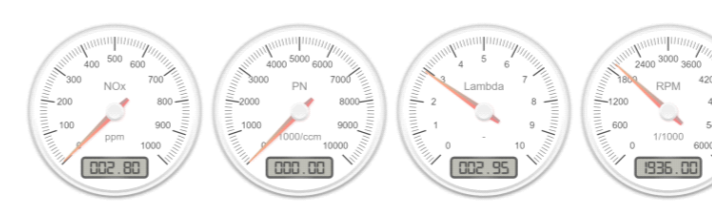
	NO _x [mg/km]	Partikel [#/km]
Euro 5	2.000 to 20.000	-
Euro 6	200 to 6.000	10 ¹⁰ to 10 ¹³

What we learned:

- From our experience of a high number of real world test on all vehicle categories and evaluation of periodic inspection programs of Diesel and Gasoline vehicles over the last 20 years we learned:
- A direct tail pipe check that is independent of the vehicle itself is required

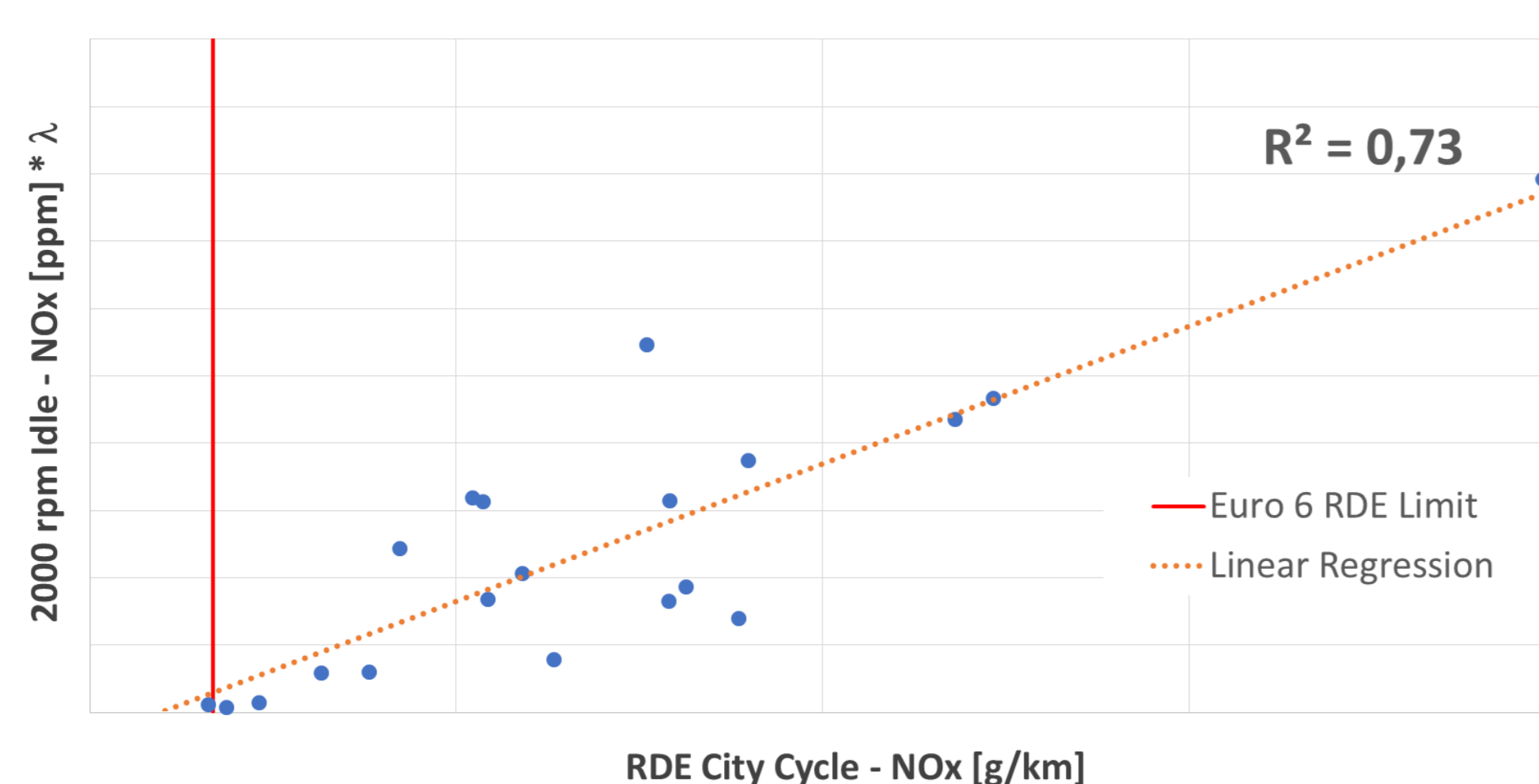


Universal Short Test Procedures for Gaseous and Particle Exhaust Components of Diesel and Gasoline Engines



- Load creation by constant idle speeds
- λ - related measurement of NOx, Particle, CO and HC
- Well-matched with established test procedure
- Good correlation with RDE measurement
- Cheat proof - no vehicle data used

NOx 2000rpm Shorttest versus RDE City Cycle Euro 5 & 6 Diesel



Particle 2000rpm Shorttest versus RDE City Cycle Euro 5 & 6 Diesel

