

Testing of AES¹ on in-service vehicles

Application of the European testing protocol: JRC test settings

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A. Vehicle preparation

- Recording mileage;
- Recording vehicle data;
- Recording inspection and maintenance information (if any);
- Visual inspection for rebuilds, modifications and leaks of the exhaust and after-treatment system;
- **Checking for OBD faults (Scan tool);**
- Checking for tyres damage;
- Checking for any anomaly which might affect the emissions performance;
- Fuel replacement (when applicable);
- PEMS installation (for on road tests).

B. Laboratory Tests Settings

Variations of the test settings were also applied changing the driving cycle (WLTP instead of NEDC) and/or the road load settings.

Standard NEDC According to ECE R83

Type	▪ Chassis dynamometer 2WD mode
Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ EUDC ▪ Soak of min. 6 hours between 20 and 30°C
Driving cycle	▪ NEDC
Test temperature	▪ 22 to 24°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

NEDC Hot Vehicle

Type	▪ Chassis dynamometer 2WD mode
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¹ Auxiliary Emissions Strategies

Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ None, check coolant and oil temperatures
Driving cycle	▪ NEDC
Test temperature	▪ 22 to 24°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

NEDC @ 10°C - Cold Vehicle

Type	▪ Chassis dynamometer 2WD mode
Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ EUDC ▪ Soak of min. 6 hours between 20 and 30°C
Driving cycle	▪ NEDC
Test temperature	▪ 10°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

NEDC @ 30°C - Cold Vehicle

Type	▪ Chassis dynamometer 2WD mode
Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ EUDC ▪ Soak of min. 6 hours between 20 and 30°C
Driving cycle	▪ NEDC
Test temperature	▪ 30°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

NEDC with speeds +10% - Cold Vehicle

Type	▪ Chassis dynamometer 2WD mode
Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ EUDC ▪ Soak of min. 6 hours between 20 and 30°C
Driving cycle	▪ Modified NEDC, speeds +10%
Test temperature	▪ 22 to 24°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

NEDC with speeds -10% - Cold Vehicle

Type	▪ Chassis dynamometer 2WD mode
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Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ EUDC ▪ Soak of min. 6 hours between 20 and 30°C
Driving cycle	▪ Modified NEDC, speeds -10%
Test temperature	▪ 22 to 24°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

NEDC, 4WD chassis dynamometer - Cold Vehicle

Type	▪ Chassis dynamometer 4WD mode
Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ EUDC ▪ Soak of min. 6 hours between 20 and 30°C
Driving cycle	▪ NEDC
Test temperature	▪ 22 to 24°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

NEDC, 4WD chassis dynamometer - Hot Vehicle

Type	▪ Chassis dynamometer 4WD mode
Fuel	▪ Reference
Road Load	▪ Tabulated ECER83 values
Vehicle pre-conditioning	▪ None, check coolant and oil temperatures
Driving cycle	▪ NEDC
Test temperature	▪ 22 to 24°C
Emissions measurement	▪ Gaseous emissions, PN ▪ CVS (bags) and modal

C. On-Road Tests

RDE Route # 1

Type	▪ On-road
Fuel	▪ Market
Vehicle pre-conditioning	▪ None, only recording oil and coolant temperatures
Driving cycle	▪ JRC RDE route #1 - Esperia
Test temperature	▪ Depending on day/time, measured
Emissions measurement	▪ Gaseous emissions ▪ PEMS
Data evaluation	▪ None ▪ RDE Type - Trip composition, Appendix 5 (Moving Window) and Appendix 7 (Excess of driving dynamics)

RDE Route # 2

Type	▪ On-road
Fuel	▪ Market
Vehicle pre-conditioning	▪ None, only recording oil and coolant temperatures
Driving cycle	▪ JRC RDE route #2 - Labiena
Test temperature	▪ Depending on day/time, measured
Emissions measurement	▪ Gaseous emissions ▪ PEMS
Data evaluation	▪ None ▪ RDE Type - Trip composition, Appendix 5 (Moving Window) and Appendix 7 (Excess of driving dynamics)

RDE Route # 3

Type	▪ On-road
Fuel	▪ Market
Vehicle pre-conditioning	▪ None, only recording oil and coolant temperatures
Driving cycle	▪ JRC route #3 - Sacromonte
Test temperature	▪ Depending on day/time, measured
Emissions measurement	▪ Gaseous emissions ▪ PEMS
Data evaluation	▪ None ▪ RDE Type - Trip composition, Appendix 5 (Moving Window) and Appendix 7 (Excess of driving dynamics)

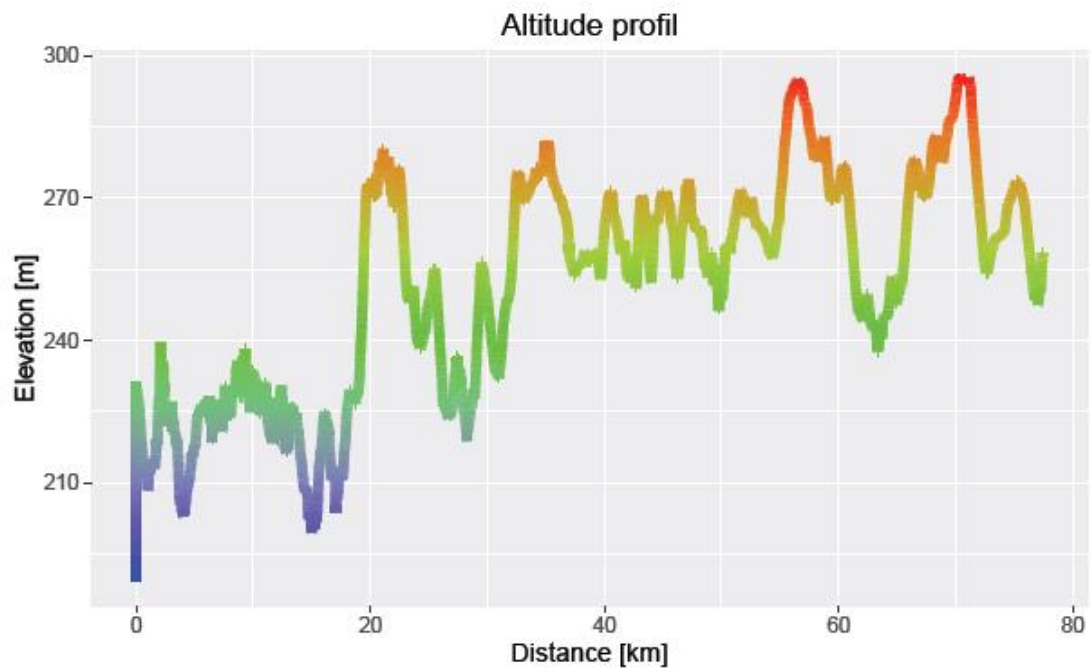
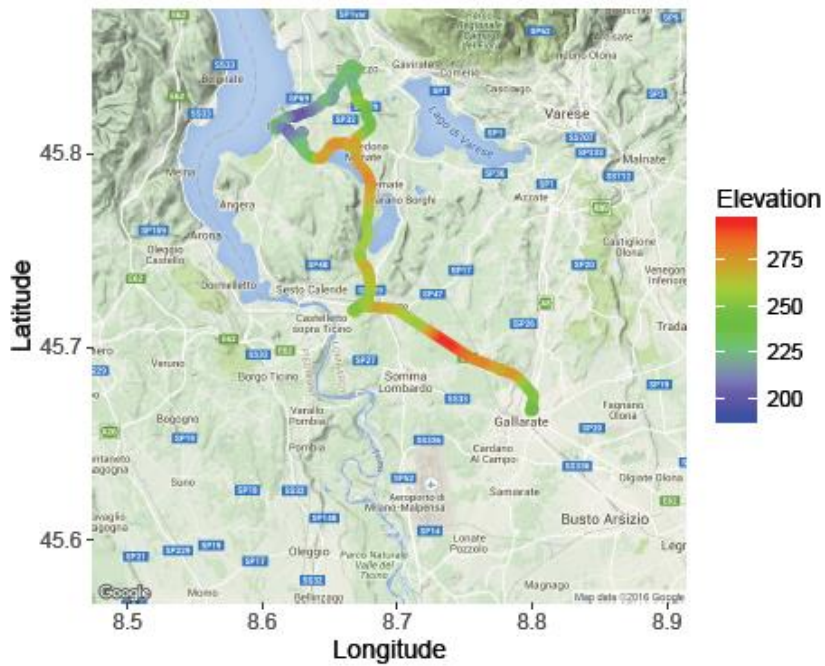
RDE Route # 4

Type	▪ On-road
Fuel	▪ Market
Road Load	▪ Not applicable
Driving cycle	▪ JRC route #4 - Milano
Test temperature	▪ Depending on day/time, measured

Emissions measurement	<ul style="list-style-type: none">▪ Gaseous emissions▪ PEMS
Data evaluation	<ul style="list-style-type: none">▪ None▪ RDE Type - Trip composition, Appendix 5 (Moving Window) and Appendix 7 (Excess of driving dynamics)

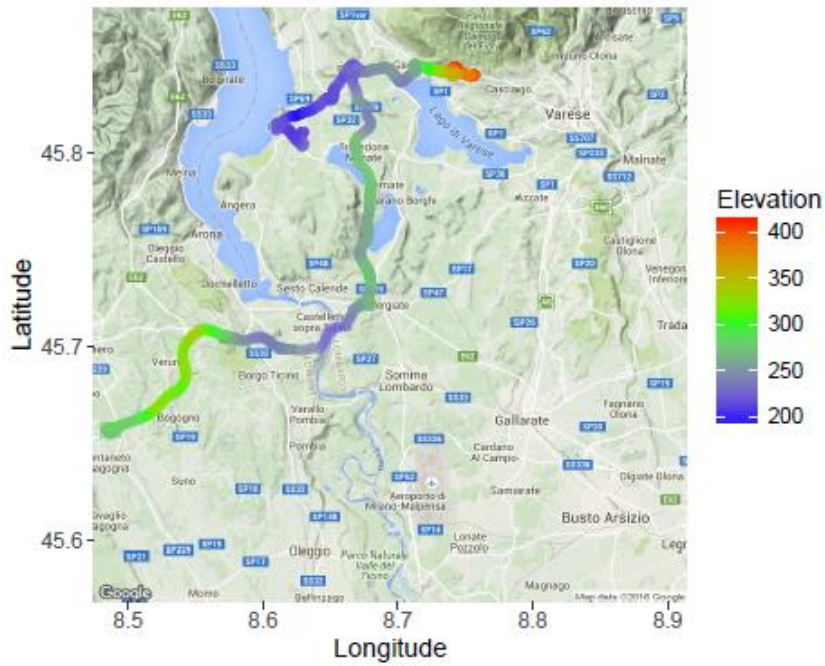
Route# 1 - Esperia

Total Distance	▪ Ca. 79
Urban Rural Motorway Distance Shares [%]	▪ 38.5 – 27.5 – 34.0
Average speed [km/h]	▪ 48.8
Average urban speed [km/h]	▪ 27.5
Cumulative altitude gain [m/100km]	▪ 631

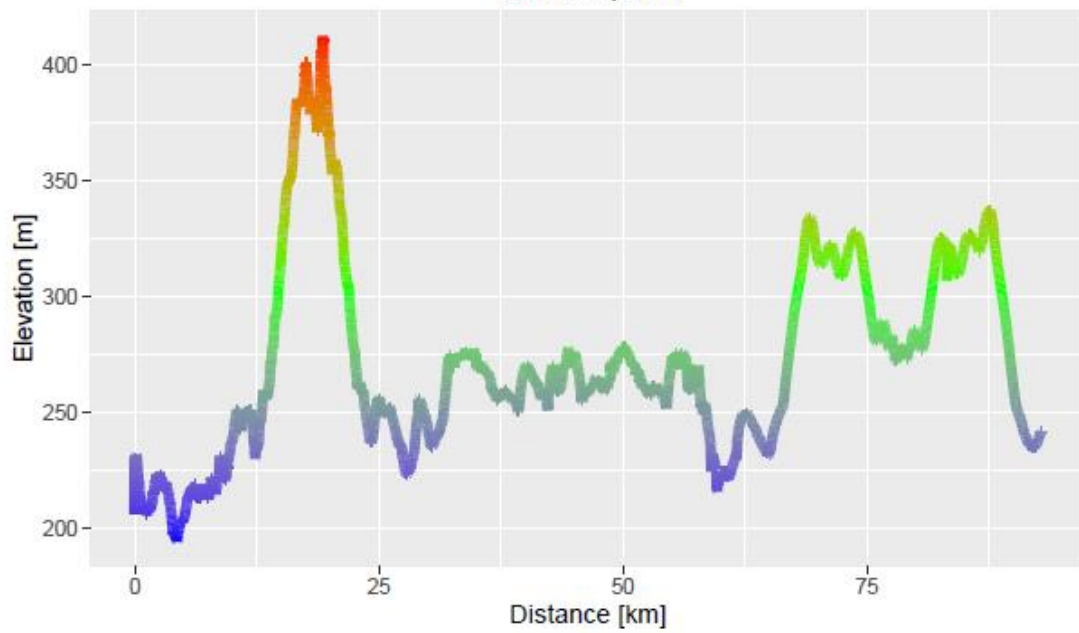


Route# 2 - Labiena

Total Distance [km]	▪ Ca. 94
Urban Rural Motorway Distance Shares [%]	▪ 36.7 – 25.7 – 37.6
Average speed [km/h]	▪ 51.0
Average urban speed [km/h]	▪ 27.5
Cumulative altitude gain [m/100km]	▪ 739

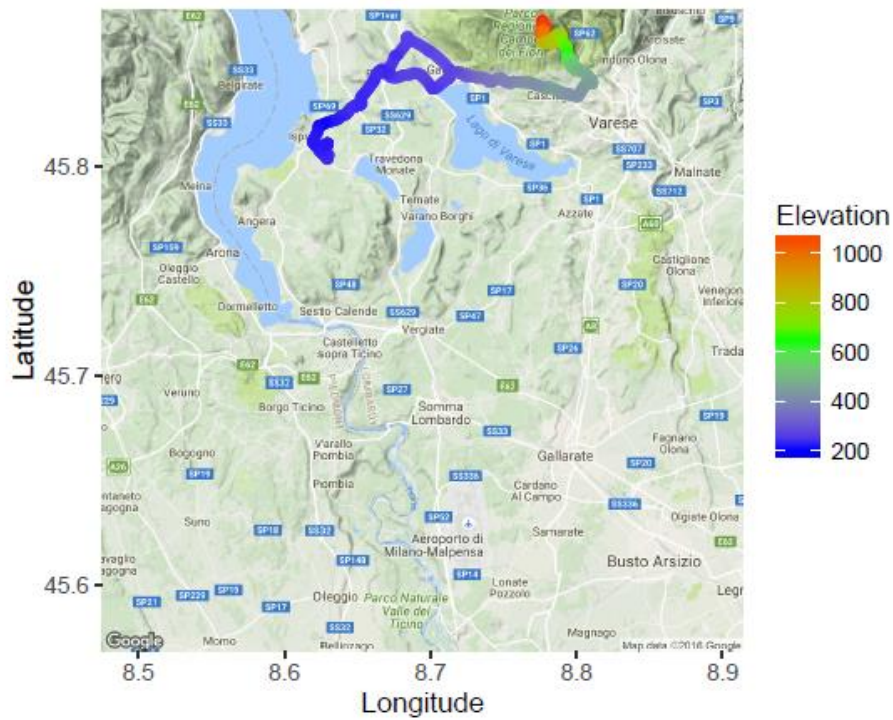


Altitude profil

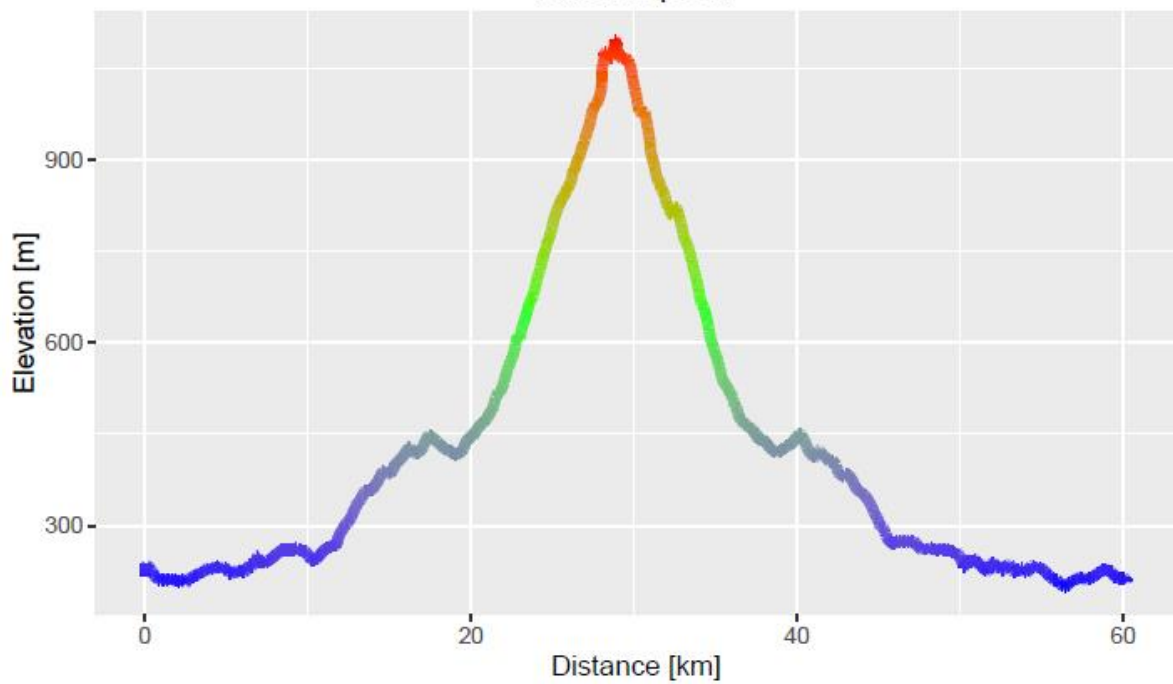


Route# 3 - Sacromonte

Total Distance	▪ Ca. 62
Urban Rural Motorway Distance Shares [%]	▪ 95.5 – 4.5 – 0%
Average speed [km/h]	▪ 34.5
Average urban speed [km/h]	▪ 33.8
Cumulative altitude gain [m/100km]	▪ 1800



Altitude profil



Route# 4 - Milano

Total Distance	▪ Ca. 141
Urban Rural Motorway Distance Shares [%]	▪ 30.1 – 13.7 – 56.2
Average speed [km/h]	▪ 60.3
Average urban speed [km/h]	▪ 30.9
Cumulative altitude gain [m/100km]	▪ 374

