Smart Emission Measurement System (SEMS) for real-world driving emissions monitoring

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INTRODUCTION

During the last decade the gap between real-world driving emissions and test-bench tests became increasingly clear. Meanwhile, all modern passenger cars and trucks in Europe must undergo an on-road driving emission test with portable emissions measurement systems (PEMS). However, to cover real-world driving conditions, a simple and easy-to-use system is required that allows for longer term monitoring.

SEMS

Smart Emission Measurement System (SEMS) consists of both measuring devices/sensors and a data platform. SEMS includes GPS, temperature, NO_x, CO_2, Lambda and NH_3 sensors, a connection with the vehicle's OBD system (e.g. for Mass Air Flow) as well as a wireless link towards the SEMS data platform. The latter one consists of a database, automated data processing and analyses and a user interface. SEMS outputs fuel consumption, NO_x and CO_2 in g/kg, and NO_x, NH_3, and CO_2 in g/km or g/kWh based on the real time sensor data

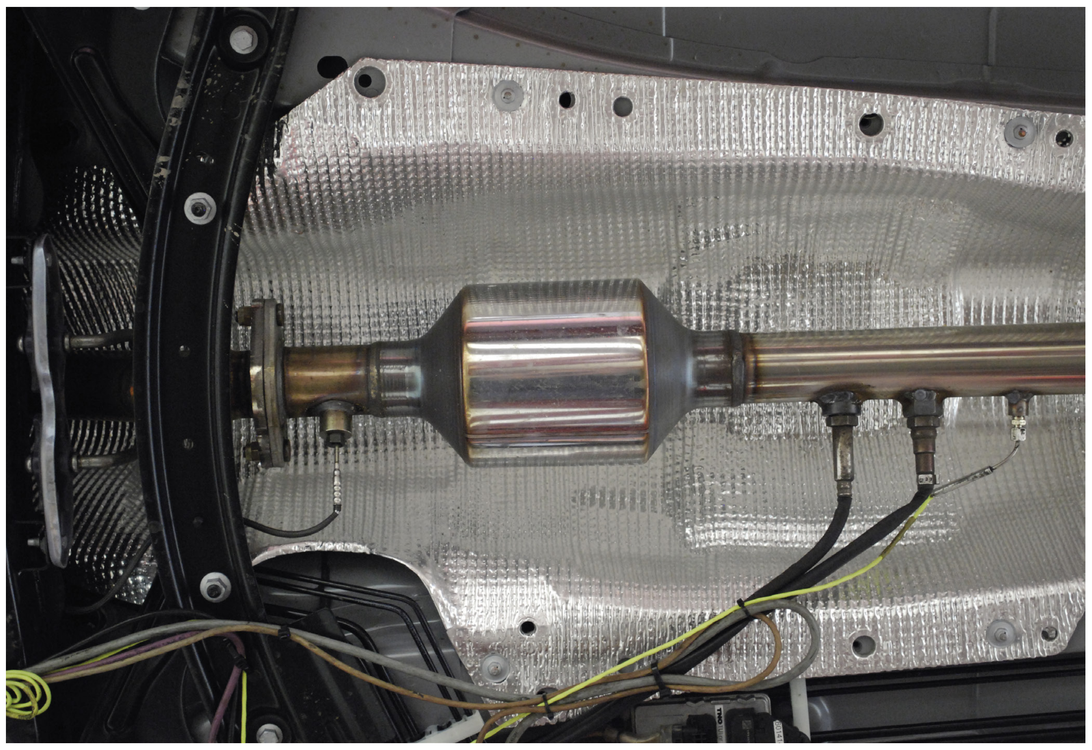

Fig 1. *SEMS sensors installed in exhaust system.*

VALIDATED SCREENING TOOL

Procedures have been developed and validated to calibrate the sensors and to perform signal processing. Together with the large amount of data already available (more than 11.000 hours of heavy duty vehicles (HDV), 2250 hours of light duty vehicles (LDV), 1875 hours of non-road mobile machinery (NRMM)), SEMS can be positioned as a validated screening tool for real driving emissions and is able to show anomalies or abnormalities in vehicle emission data.

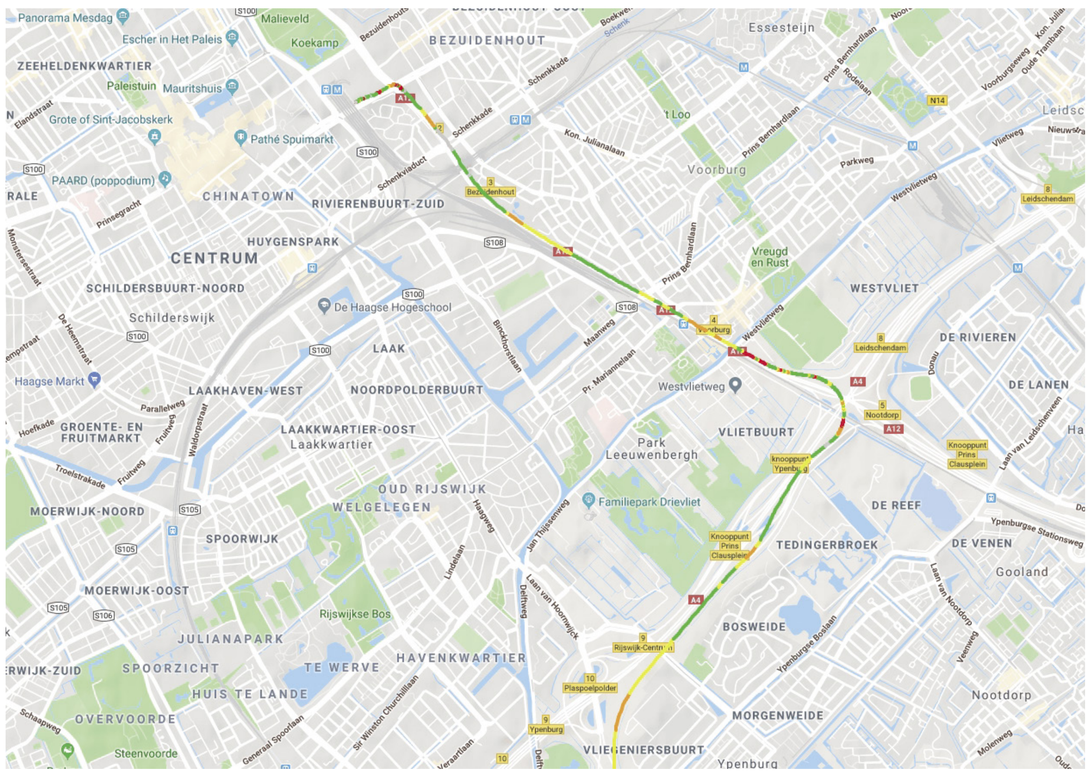

Fig 2. *Visualization of calculated results in the SEMS user interface, in this example CO_2 emissions.*

FURTHER DEVELOPMENT

At this moment, SEMS can be used for diesel engines on vehicles, NRMM, locomotives and ships. Further short term developments include:

- Adaptations for use with petrol powered engines.
- Measurement of Particulate Matter and Particle Number concentration.
- Applications for (hybrid) electrical vehicles.

For future application of the system, consumers and end users are targeted as well. The system can provide information based on real driving emissions for the comparison of fuel economy and true environmental performance, to help end-users choose vehicles that suit their requirements best.

To guarantee successful market introduction, TNO and HORIBA collaborate on the industrialization and large-scale deployment of SEMS.

CONCLUSION

SEMS is a screening tool capable of generating large amounts of real driving emission data, calibrated and validated, that can be used as input for:

- Emission models,
- Environmental policy making,
- Fleet testing over long periods,
- Characterizing emission behavior,
- Development and analysis toolboxes for aftertreatment calibration and validation by OEMs,
- Emission and fuel consumption performance comparability purposes for end users.