Market surveillance: A new business
In the field of emission reduction
Whole Vehicle Type-Approval System (WVTA):

An update of the EU emission regulation


• The major overhaul of the EU type-approval framework for motor vehicles was adopted on 30 May 2018.


• The new regulation will make vehicle testing more independent and increase surveillance of cars already in circulation. It will:

  • raise the quality level and independence of vehicle type-approval and testing
  • increase checks of cars that are already on the EU market
  • strengthen the overall system with European oversight
  • It becomes mandatory for all new vehicle models as of 1 September 2020. The new rules go together with Commission initiatives such as the proposal for a new deal for consumers. In a Dieselgate-type scenario, this initiative allows victims of unfair commercial practices to obtain remedies collectively through a representative action.
GTAA : Granting Type Approval Authority

- Approval authorities are established or appointed by EU countries and mandated by the Commission. The approval authorities have skills for:
  - all aspects of the approval of a type of vehicle, system, component.
  - acting as the contact point for the approval authorities of other EU countries
  - ensuring that the manufacturer meets his obligations regarding the conformity of production
  - designating the technical services
  - Information gathering & risk assessment (define ISC tests constraints)

TS: Technical services

- A technical service is an organization or a body designated by the national approval authority as a:
  - testing laboratory to carry out tests
  - or as a conformity assessment body to carry out the initial assessment and other tests or inspections on behalf of the approval authority
Version layers of the market surveillance

- **Before production**
  - TYPE APPROVAL including DURABILITY & OBD
- **End of production line**
  - COP: CONFORMITY OF PRODUCTION
- **6 month < ... < 5 years**
  - ISC: IN-SERVICE CONFORMITY
  - 15.000 < ... < 100.00 Km
  - Whichever is sooner
- **Any time**
  - RSI: ROAD SIDE INSPECTION
- **Min. 4 years**
  - PTI: PERIODICAL TECHNICAL INSPECTION
  - + every 2 years

*Emissions testing throughout vehicle useful life*
ISC: In-Service Conformity definition process

Main Responsibility

- **Information gathering & Risk Assessment**
  - GTAA

- **ISC Testing**
  - TS + OEM

- **Compliance Assessment**
  - GTAA + OEM

- **Remedial Measures**
  - GTAA + OEM

- **Reporting**
  - GTAA

As of 1 January 2020, 5% of the ISC families per manufacturer per year or at least two ISC families per manufacturer per year, where available.

The requirement for testing a minimum of 5% or at least two ISC families per manufacturer per year shall not apply to small volume manufacturers.
Selection of vehicles for ISC Testing

- Driven in the **Union** for at least 90% of its driving **time**.
- Maintenance record which shows that the vehicle has been **properly maintained**
- Vehicles exhibiting indications of **abuse, improper use** that could affect its emissions performance, tampering or conditions that may lead to unsafe operation shall be **excluded**
- Vehicles shall **not** have undergone **aerodynamic modifications**
- If the information stored in the on-board computer shows that the vehicle was operated after a **fault code** was displayed and a **repair was not carried out**
- If the **fuel** from the vehicle tank does not meet the **applicable standards**
- If the vehicle is within 800 km of a scheduled **maintenance service**, **No active fault code** for the pollution control devices

<table>
<thead>
<tr>
<th>EU Registration</th>
<th>Number of sample lots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 100.000</td>
<td>1</td>
</tr>
<tr>
<td>100.001 &lt; ... &lt; 200.000</td>
<td>2</td>
</tr>
<tr>
<td>Above 200.000</td>
<td>3</td>
</tr>
</tbody>
</table>

Each sample lot is minimum 3 vehicles, maximum 20 vehicles (according results).
In-Service Conformity: Information gathering & Risk Assessment

- GTAA shall gather all relevant information on possible emission non-compliances relevant for deciding which ISC families has to be checked in a particular year.
- GTAA shall take into account all source of information indicating vehicle types with high emissions in real driving conditions.
- That information shall be obtained through the use of appropriate methods, which may include remote sensing, simplified on-board emissions monitoring systems (SEMS) and testing with PEMS.
- The number and importance of exceedances observed during such testing may be used to prioritize ISC testing.

PEMS  Remote Sensing  SEMS  Alternative Solution
Key concept:
From a simple block trip to Approval cycles test results

REAL •

NEDC score
WLTP score
RDE score

=
proposal for ISC and Market surveillance in order to manage information gathering to point out suspicious vehicles

RSD as a massive solution to spot faulty vehicles / categories

REAL-e to evaluate Single vehicle on a block trip

Raw pollutant analysis

Vehicle emission modeling

If necessary: Evaluation with PEMS on a RDE trip

1 second 30 mn 1 day

• Learning from Measurement
  • Conformity factor estimation
**Input Data flow**
- **Plate number or VIN**
  - Carburant
  - Vehicle mass
  - Gear box...
- **Analyser**
  - Polluting gas in volume
  - Smoke measurement (in progress)
- **EOBD Dongle**
  - Engine speed, water temp., speed, Load...
  - VIN
- **GPS Signal**
  - Speed
  - slope
  - local temperature...

**Cloud based algorithms**

**Webservices**
- Engine torque
- Polluting gas in mass
- Driving monitoring/trip...

**Off-line calculation and projection on a reference cycle**
- Vehicle Modeling
- Engine Modeling
- After treatment modeling

**Calibration Protocol**
- Calibration 1: Road law
- Calibration 2: Speed/acc.
- Calibration 3: Gear shift
- Calibration 4: Nox/CO2

**Score Board**

- **Results on the operated trip**
- **High Emitter Identification**
  - with the associated conditions
- **Extrapolation**
  - vs NEDC approval cycle
  - vs WLTC approval cycle
  - vs RDE approval cycle
- **Conformity factor**
  - CF: 10
  - 2.1
  - 1
use case: Test campaign

**Vehicle**
- Peugeot 308SW
- Diesel 1.6L Hdi 115, 1300kg
- 2014 (Euro 5)

**8 trips**
- 3 RDE type:
  - 80 km, 1h30min
- 5 « go around the neighborhood » type:
  - 7 km, 15min
use case: Initial Finding / Raw data

• Findings:
  • Laboratory PEMS and REAL-E provide similar raw results
  • The events are well represented by the model but the quantification can be improved
  • Data fusion between model and measure opens up opportunities for improvement
use case: Exemple of Re calibration

**Findings:**
- **Road law** is unknown in real conditions (vehicle load, vehicle condition...)
- **Gearbox ratios from database** are not accurate
- **Driver behaviour** is difficult to estimate

**Teachings:**
- **Engine speed** needs to be calibrated
- Clustering method gives accurate results
- A reference driver model will be kept to project vehicle reference scores
**use case: After recalibration**

**Findings:**
- The CO2 estimation is correct, once the regime is fitted
- For NOx, calibration improves significantly the result

**Teachings:**
- AFR is sometimes incorrectly estimated, which can lead to an error in the exhaust flow rate
- Euro 6 equipped vehicles present additional difficulties due to their complexity but the measurement reduces uncertainties
use case: Projection on Approval cycle

Measurements over 8 trips

<table>
<thead>
<tr>
<th></th>
<th>NEDC</th>
<th>WLTC</th>
<th>RDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ [g/km] Simu / Measure</td>
<td>99</td>
<td>111</td>
<td>116</td>
</tr>
<tr>
<td>Conso. [L/100km]</td>
<td>3.7</td>
<td>4.2</td>
<td>4.4</td>
</tr>
<tr>
<td>NOx [mg/km] Simu / Measure</td>
<td>550</td>
<td>600</td>
<td>630</td>
</tr>
<tr>
<td>CF Euro 5</td>
<td>3</td>
<td>3.3</td>
<td>3.5</td>
</tr>
</tbody>
</table>

- The thresholds are known, tolerance are EU defined with ISC specification...
- This methodology is allowing to identify “High emitters” quicker and easier
### Cost Benefit Analysis

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Cost</th>
<th>Time Setting</th>
<th>Time Performing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory PEMS</td>
<td>150-200 k€</td>
<td>3 h</td>
<td>3 h (need to repeat test)</td>
</tr>
<tr>
<td>Laboratory Chassis Dyno</td>
<td>&gt;2000 k€</td>
<td>24h (soaking)</td>
<td>1 h</td>
</tr>
<tr>
<td>PTI Chassis Dyno</td>
<td>30 k€ + civil works</td>
<td>10 mn</td>
<td>5 /10 mn</td>
</tr>
<tr>
<td><strong>REAL·G</strong></td>
<td><strong>10 k€</strong></td>
<td><strong>5 mn</strong></td>
<td><strong>20 mn</strong></td>
</tr>
<tr>
<td>PTI Gas analyser/smokemeter</td>
<td>4-6 k€</td>
<td>1 mn</td>
<td>3 mn</td>
</tr>
</tbody>
</table>

- **40 cheaper** or **40 more efficient than RDE Cycles**