PLenary Session Two

Future Directions for Vehicle Inspection

Al Bustan Rotana Hotel, Al Rashidya Ballroom A & B
Plenary Session Two

Presentation 1

STRATEGIC OVERVIEW OF THE FINDINGS OF THE CITA STUDY ON TESTING ELECTRONICALLY CONTROLLED SAFETY SYSTEMS (ECSS)

Christoph Nolte

CITA, Deputy Chair of the CITA Regional Advisory Group Europe
Contents

1. Introduction

2. Strategic implications and benefits

3. Role of roadworthiness inspections

4. Way forward
1. Introduction
European Measures in road safety

- **Objective:** To help improve road safety and reduce emissions
  - Halve number of road deaths in EU by 2020 starting from 2010

- **Method:** Progressive strengthening and harmonisation of roadworthiness tests (and technical roadside inspections) whilst adapting to technical progress
  - Once in fleet, vehicles should continue to meet safety standards throughout their lifetime
Milestones in PTI development

- **88/499/EEC**: Include light goods vehicles
- **96/96/EC**: Consolidate technical amendments
- **2009/40/EC**: Recast of Directive 96/96/EC
- **2014/45/EU**: Include electronic systems (ABS, ESC), methods for other vehicle categories
- **2010/48/EU**: Include passenger cars, introduce comitology procedures
- **2000/30/EC**: On technical roadside inspections
- **77/143/EEC**: Commercial vehicles > 3.5t, taxis and ambulances only
EU Roadworthiness Package 2012

=>> 2014/45/EU

- Objectives
  - Harmonised, high quality of periodic roadworthiness tests
  - Lowering administrative burdens, increased efficiency of roadside inspections
  - Reduction of the emissions of GHG and air pollutants from road transport
    >> expected benefits: 1,200 fatalities less per year

- Three components
  - Periodic roadworthiness tests: 2014/45/EU
  - Technical roadside inspection: 2014/47/EU
  - Registration documents: 2014/46/EU
Objectives

• Develop **new inspection methods and requirements for tools** for electronically controlled safety systems (ECSS) suitable for use in a legislative regime

• Perform **cost benefit analysis** for introduction of methods into European legislation
Team members

IERC-GmbH

EGEA

CITA

GDCA

bast

ACTIA®

HELIL GUTTMANN SOLUTIONS

TECHOMOTOR

BOSCH

DEKRA

Conference and 17th General Assembly | 14-16th April | DUBAI U.A.E.
Test centres and tools

Conference and 17th General Assembly | 14-16th April | DUBAI U.A.E.
Results

- Electronically Controlled Safety Systems (ECSS) contribute highly to reduction of road accident casualties by avoidance of accidents and reduction of injury severity.
- ECSS Study has shown that benefits from ECSS inspections are significant.

>> Testing of functionality / performance of ECSS required

>> Test method increased failure rate by 4.8 %
2. Strategic implications
Strategic key elements:

1. Maintain ECSS during the vehicle life time
2. Implement functionality test for ECSS
3. Design of test methods
   - Using an independent approach
   - Using OBD
   - Using external test equipment
4. Vehicle specific Information necessary
Role of roadworthiness inspections:

Ensure:

• Vehicles are still equipped with ECSS
• Safety surplus from ECSS
• ECSS are not manipulated
• Functionality is still given
4. Way forward
Next steps

• Support the dialog with ACEA:
  • Develop format and content of information necessary for PTI

• Contribute recommendations
  • Roadworthiness Committee (RWC)
  • Technical working group of RWC
Thank you very much for your attention!
Plenary Session Two

Presentation 2

**Worldwide Harmonised Light Vehicles Test Procedure (WLTP) and Real Driving Emissions (RDE)**

Helge Schmidt

Head of Exhaust Emission Division, CITA Technical Expert for Exhaust Emissions, TÜV NORD Mobility, Germany
Road traffic related air quality issues

Exposure to particulate matter with an aerodynamic diameter of 10 μm or less (PM10) in 1100 urban areas*, 2003–2010

- Annual mean PM10 (µg/m³)
  - <20
  - 20–40
  - 40–60
  - 60–90
  - 90–140
  - ≥150
  - Not applicable

* The mean annual concentration of fine suspended particles of less than 10 micrometers in diameter is a common measure of air pollution. The mean is a population-weighted average for urban population in cities above 100,000 inhabitants of a country.
New European Driving Cycle (NEDC)

- **Cold start (20 to 30°C)**
- **Duration:** 1180 seconds
- **Distance:** ca. 11 km
- **Average speed:** 33.6 km/h
- **Maximum speed:** 120 km/h

**Graph:**
- Vertical axis: $v$ [km/h]
- Horizontal axis: $t$ [s]
- Graph shows oscillations in speed over time.
Type approval versus on-road fuel consumption

Diesel and gasoline cars: Fuel consumption (l/100km)

- 2001: Official fuel consumption 7.3 l/100km, On-road fuel consumption 6.8 l/100km, +7%
- 2005: Official fuel consumption 7.3 l/100km, On-road fuel consumption 6.5 l/100km, +13%
- 2009: Official fuel consumption 6.8 l/100km, On-road fuel consumption 5.8 l/100km, +17%
- 2013: Official fuel consumption 6.6 l/100km, On-road fuel consumption 5.1 l/100km, +30%

ICCT: From laboratory to road – a 2014 update of official and “real-world” fuel consumption and CO₂ values for passenger cars in Europe
„The Commission should keep under review the need to revise the New European Drive Cycle as the test procedure that provides the basis of EC type approval emissions regulations. Updating or replacement of the test cycles may be required to reflect changes in vehicle specification and driver behaviour.“
Emission regulations worldwide

- US regulation
- Based on US regulation
- European regulation
- Based on European regulation
- Based on European regulation
- Japanese regulation
In November 2007 an UNECE working group was established to create a Worldwide Harmonized Light-Vehicles Test Procedure (WLTP).

Target is a harmonized measurement of exhaust emissions and energy consumption for different drivetrains (Gasoline, Diesel, LPG, CNG, H2, HEV, EV).

The work is focused on a harmonized representative driving cycle (DHC) and test procedure (DTP).

On 2014-03-12 the World Forum for Harmonization of Vehicle Regulations (WP.29) accepted the current GTR concluding Phase 1a of WLTP.
WLTC Version (GTR: 3B*)

*) power to unladen mass ≥ 34 W/kg; $v_{\text{max}} > 120$ km/h
WLTC Version (GTR: 3B*)

*) power to unladen mass ≥ 34 W/kg; $v_{\text{max}} > 120$ km/h
CO$_2$ in different driving cycles (1)

TÜV NORD on behalf of the German Ministry of Environment 2013
WLTP Test Procedure

- improvement of coast down procedure
- correction of calculation, definition of test conditions
- test temperature set point 23°C
- test cell +/-5°C
- soak area +/- 3°C
- test mass including optional equipment
- inertia, stepless approach
- reduced tolerences for load setting
- no external battery charging after start of preconditioning test cycle
- RCB correction for all vehicles
- ...

IFM - Drivetrain / Emissions  Passenger cars / Motorcycles  Emissions / Performance / Consumption
21/04/2015
WLTP test mass

**TM_L** used for:
- >> CO₂ emissions (lower value for regression)
- >> coastdown (optional, OEM choice)

**TM_H** used for:
- >> non-CO₂-emissions (worst-case)
- >> CO₂ emissions (upper value for regression line)
- >> coastdown

**LM** = laden mass, gross vehicle weight

extrapolation allowed up to [50 kg]
(in case that additional options added later)

**TM_H** = test mass
- + 15% of LM-RM_H
- **RM_H** (heaviest vehicle reference mass)
- + 100 kg
- **OM_H** = unladen mass + mass of all available optional equipment

**UM** = unladen mass (empty vehicle)
intelligent battery management: the battery is charged under certain driving conditions only; energy is taken out of the battery during the driving cycle $\Rightarrow$ lower CO$_2$ value
NEDC $\rightarrow$ WLTP, $\text{CO}_2$ emissions

TÜV NORD on behalf of Transportstyrelsen
Climatized 4 wheel dynamometer of TÜV NORD
Exhaust emissions of passenger cars and light duty trucks in Europe are measured by using the NEDC under well defined ambient conditions in a laboratory. The NEDC represents only a small part of all driving conditions in real traffic.

„Revisions may be necessary to ensure that real world emissions correspond to those measured at type approval. The use of portable emission measurement systems and the introduction of the ‘not-to exceed’ regulatory concept should also be considered.“

Real Driving Emissions
• In Europe it is discussed how to measure exhaust emissions in real traffic (Real Driving Emissions = RDE).

• Due to European air quality regulations NOx emissions are the main issue of RDE.

• European Commission is also interested in particle measurement especially on gasoline direct injection.

• Emissions can be measured by using Portable Emission Measurement Systems (PEMS) in real traffic.

• TÜV NORD is carrying out research programs on behalf of the German government within the RDE process. Results are sent to JRC.
Light Duty PEMS:

- Exhaust Flow Meter
- NDIR: CO, CO$_2$,
- O$_2$ - Sensor
- NDUV: NO + NO$_2$ = NOx
- FID: THC
- Power Supply: Li-Fe-Battery, 200 Ah, Measurement time 4h
TÜV NORD PEMS-Route (RDE-Draft 15.10.2014)

- Distance: about 107 km
- Duration: about 115-120 minutes
- Urban Driving \(v_{\text{average}} \geq 20\text{km/h} \): about 33%
- Extra Urban Driving: about 33%
- Motorway Driving \(v_{\text{max}} \leq 160\text{ km/h} \): about 33%
  (related to driven distance, ±5%)
Driving conditions in real traffic

- Engine temperature
- Traffic
- Ambient conditions
- Battery
- Driver
- Engine load
- Engine oil
- Fuel quality
- Engine speed
**TÜV NORD PEMS-Route**

**Example of M.A.W.- Method in Emroad**

- **Graph**:
  - **Y-axis**: MAW CO2 Emissions [g/km]
  - **X-axis**: MAW Average Speed [km/h]

- **Legend**:
  - Out of range
  - "severe" driving
  - "normal" driving
  - "soft" driving

- **Data Table:**
  - Severity Category (URBAN, RURAL, MOT.)
  - Corrected URM Weight

- **21/04/2015**

**IFM** - Drivetrain / Emissions Passenger cars / Motorcycles Emissions / Performance / Consumption
Components to be measured

NOx and CO:
- NOx and CO will be measured on PI and CI vehicles.

CO₂:
- CO₂ is needed as reference value for data evaluation.

PN:
- Particle Number will be added
- JRC is testing different PN-PEMS candidate instruments
- if PN-PEMS is not available, Random Cycle will be a backup solution.
Exhaust emissions of passenger cars and light duty trucks in Europe are measured in the NEDC.

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The work is focused on a harmonized representative driving cycle and test procedure.

In Europe it is discussed to measure exhaust emissions in real traffic (Real Driving Emissions = RDE).
Thank you for your attention!

Helge Schmidt
Manager
IFM – Drivetrain / Emissions
Passenger cars / Motorcycles
Emissions / Performance / Consumption

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Plenary Session Two

Presentation 3

More Effective Testing Through Interactive Test Methods and Equipment

Neil Pattermore

EGEA Technical Advisor
Who are EGEA?

EGEA

European Garage Equipment Association

- Founded in Paris in 1980.
- Gathers 11 national trade associations from 11 European countries and 1 industry member (AVL DiTEST – Austria)
- Represents the interests of garage and test equipment manufacturers and importers

Our mission

- Achieving a high level of quality for products and test procedures
- Upholding stringent safety rules
- Creating common rules regarding design, manufacturing, installation, servicing and operation of garage and test equipment.
PTI centres today

All our devices communicate either wirelessly or wired according to various protocols.
PTI centres today

Vehicle Inspection Management

Government Agency coupling
- Report
- Process Mgt
- Data collection
- Networking
- Equipment

Solution for Motorcycle, Light & Heavy Vehicles
Software management: Local PTI & Multi sites
New systems – new challenges

- New systems – e.g. headlight systems, stability systems, active cruise control, eCall, AEBS, ....etc.


- Although a deeper investigation would be necessary, vehicle safety system failures were detected which were not able to be detected by the vehicle’s on-board diagnostic systems (OBD).

- The reliability rates of electronic systems are broadly the same as mechanical systems, but can become a greater issue as the vehicle ages.
New systems – new test methods

Test Lane

ECU-Diagnostics Interface

ECU-Diagnostics Content

ECU-Diagnostics

PTI database
The next step is to automate the Electronically Controlled Safety System (ECSS) functionality testing.

The electronic vehicle communication interface is used to control the vehicle safety system to create the functionality, with the results measured on existing PTI test equipment.

Control of the system to provide functionality testing (non-intrusive, not dependent on component specification, but functionality)
By going one stage further and controlling the vehicle safety system with the measurement equipment results by linking this back to the control unit, a complete automated test sequence is possible:
New headlight beam technology
Headlamp system developments

- **HALOGEN 1964**
- **XENON 1991**
- **FULL LED 2009**
- **MATRIX LED 2013**
- **LASER 2015**
Matrix LED system – lighting control
Future test requirements

High beam area
Future test requirements

High beam area

< 1 lux
Charge Coupled Device (CCD) imaging sensor system

Photo sensor LED barrier system
Headlamp tester screen design: non-imaging sensor

Opening for position-assist laser

Opening for light sensitive photo cell
The green area on the diagram shows the light distribution from the lefthand headlamp.

The arrow indicates the vertical cut-off and must be on the 0° line.

The righthand headlamp produces a mirrored image of the green area.

**Relevant Setting Range**

-5° -4° -3° -2° 0° -1° +1° +2° +3° +4° +5°
The green area on the diagram shows the light distribution. The headlamp vertical cut-off position, in increments of 0.2°, can be read on the test screen (left or right side).

The distance to the 0° line is indicated by the red arrow. The headlamp system function should match the test sequence control input signals.

**NOTE**: there is no manual adjustment possible!
Functional headlamp testing

- Camera signal input
- Vehicle interface
- Headlamp system functionality

- Test sequence control
- Bi-directional communication
- Functionality check
Interactive ABS testing
Interactive ABS testing - flowchart

Start: Rollerset left

Push brake (app. 1,000 N)

Start: ABS-Test left → Actuation ABS left → Function call "Start ABS depressurise left"

Analysis ABS-Test left → Stop: ABS-Test left → De-actuation ABS left → Function call "Stop ABS depressurise left"

Stop: Rollerset left

EGEA  Braketester  ECU-Diagnostics
Interactive ABS and brake test sequence
So what is needed for functionality testing?

- Direct communication with the vehicle to control the on-board ECSS with off-board assessment (brake tester, headlamp tester, eCall receiver...)

- PTI test method that is quick, accurate and automated wherever possible.

- Vehicle specific technical information from the vehicle or ECSS manufacturer to create a PTI database.

- Automatic and sequential testing of all the vehicle’s safety systems.
And finally……

EGEA NET for ‘plug and play’ test equipment communication
EGEA are developing a network communication standard that can be used to integrate PTI test equipment and coordinate test results as well as supporting secure communication to test authority/national databases.

Electronic summary of test
By automating the test sequence, the PTI test can include more advanced test methods, greater objectivity and enhanced PTI productivity.

Test report transmission to national results databases
Support cross-border verification of PTI test certificate validity.
Thank you!
Question 1:
How important do you think this is for the future of emission testing?

Answer Choices:
A. Highly Important
B. Moderately Important
C. Less Important
D. Not Important at All
Question 2:

How quickly do you think that OBD will provide an effective alternative to tailpipe testing?

Answer Choices:

A. It already is
B. Within one (1) year
C. Within five (5) years
D. Within ten (10) years
E. Not for the foreseeable future
Question 3:

How important is this concern?

Answer Choices:

A. Highly Important
B. Moderately Important
C. Less Important
D. Not Important at All
Question 4:

Do you think that electronic systems are more or less reliable after 5 years than mechanical ones?

Answer Choices:

A. Much more reliable
B. Generally more reliable
C. About the same
D. Generally less reliable
E. Much less reliable
REFRESHMENT BREAK

15:00 – 15:45

PLEASE RETURN PROMPTLY FOR SESSION 1 OF THE WORKSHOPS AND DISCUSSION FORUM