



European Commission

Enterprise Directorate General

Asian Vehicle Emission Control Conference (AVECC)

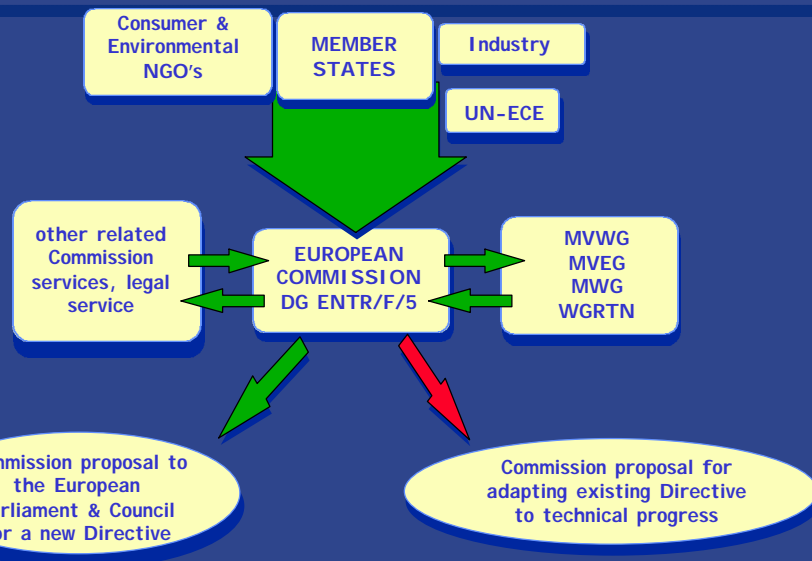
Bangkok 2001

Emissions Testing and Type- Approval

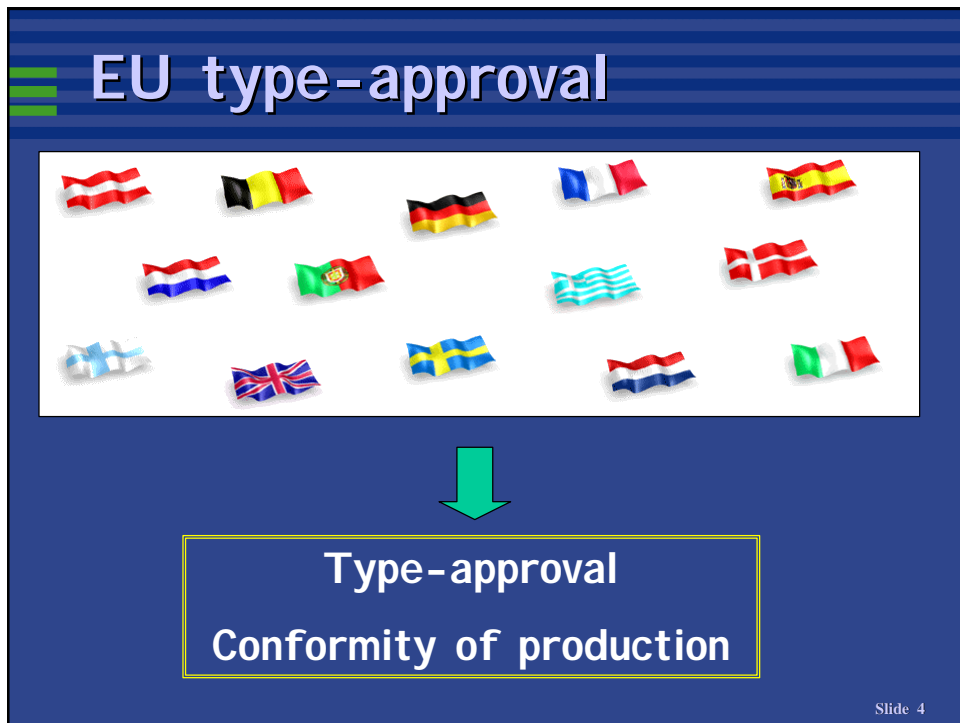
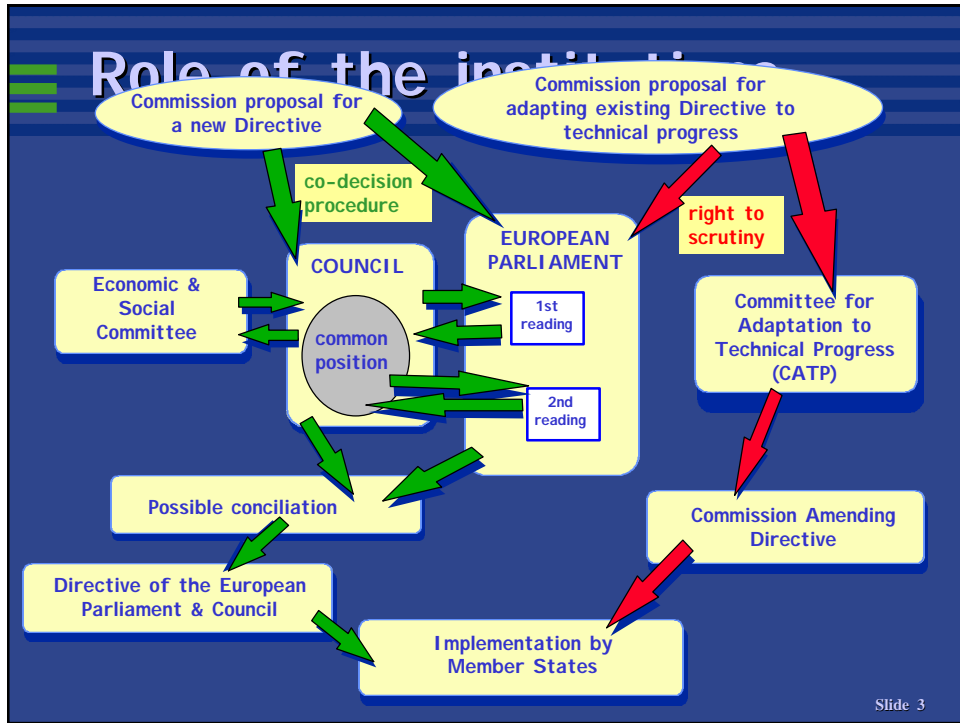
Dr Paul Greening

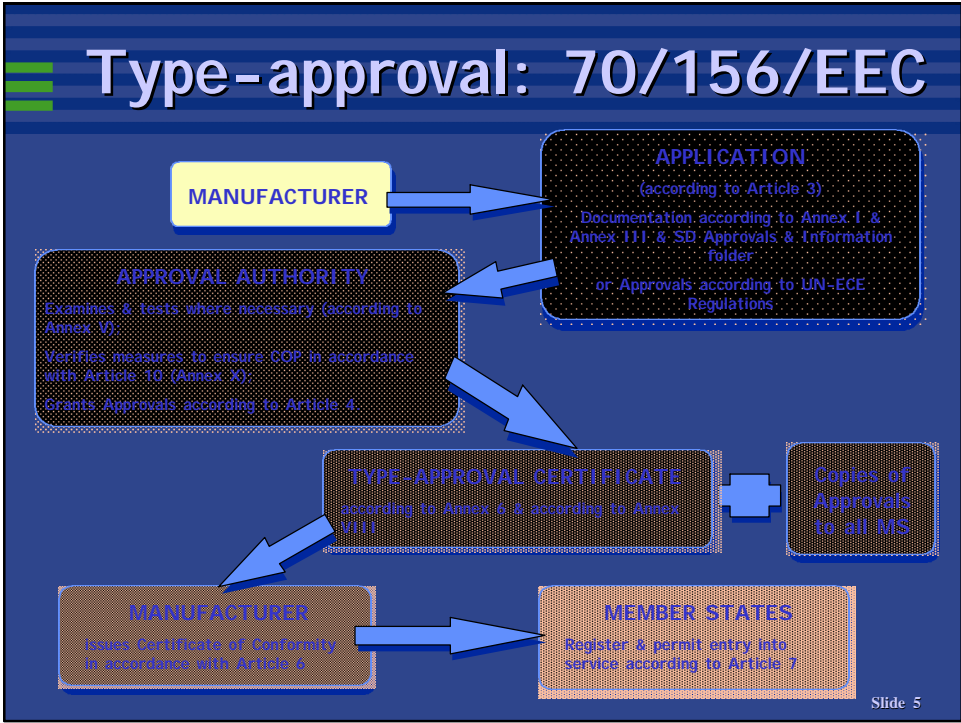
Enterprise Directorate-General

Preparation of proposals



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ADDITIONAL TECHNICAL MEASURES FOR LIGHT-DUTY VEHICLES

Directive 98/69/EC

In-Use Conformity Testing

- The Commission's Auto-Oil programme demonstrated the cost effectiveness of in-use compliance testing;
- Directive 1999/96/EC brought in-use compliance testing within the framework of EU type-approval;
- In-use compliance testing is the third measure that a vehicle must comply with in addition to type-approval and checking of conformity of production.

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Background

- Euro III vehicles must comply with the limits over 80,000 km or 5 years useful life;
- From 1 January 2005 distance rises to 100,000 km;
- In-use compliance testing is a two stage process carried out by the original type-approval authority:
 - audit of manufacturer supplied information;
 - selection and possible testing of in-use vehicles.

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An 'in-use family'

- A manufacturer may define vehicles in terms of a 'family' according to common characteristics:
 - combustion process and fuel;
 - number of cylinders and block config;
 - method of engine fuelling (direct or indirect);
 - type of cooling medium and aspiration;
 - type of catalytic converter;
 - type of particulate trap (with or w/o);
 - exhaust gas recirculation (with or w/o).

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Scope of audit information

- Minimum information a manufacturer must provide:
 - manufacturer, vehicle types covered, vehicle ID numbers, type-approval numbers;
 - vehicles included in the in-use family;
 - details of any field fixes or recalls;
 - time period data collected, vehicle build periods;
 - indication records from the OBD system.

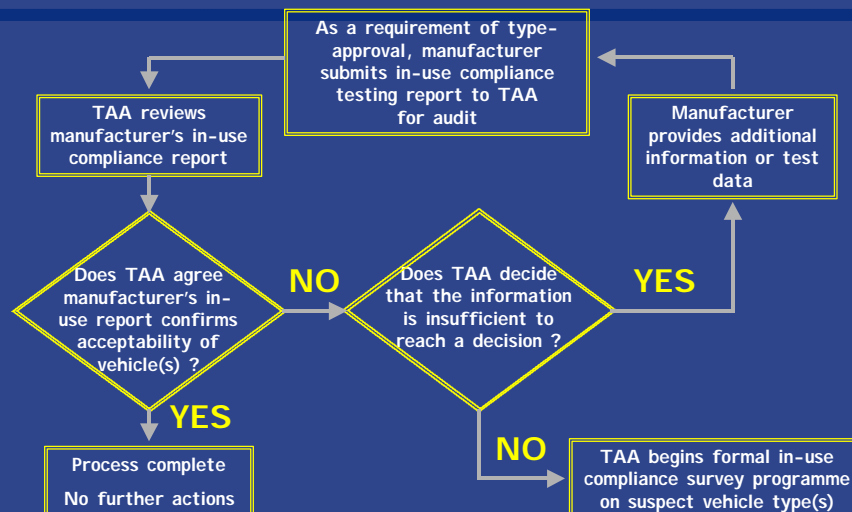
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Scope of audit information

- Method of locating vehicles;
- Vehicle selection and rejection criteria;
- Types of tests used;
- Acceptance or rejection criteria - reasons;
- Sample size and sampling plans used;
- Service and repair histories;
- Test data - fuels, vehicle distance, test conditions, dynamometer settings, test results from at least three different vehicles per family.

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Process - audit



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Approval authority decides

- On the basis of the audit information the authority decides:
 - in-use conformity of a vehicle type or in-use family is OK - no further action;
 - information supplied is insufficient - more information needed from manufacturer;
 - in-use conformity of a vehicle type or vehicle type(s) within a family is unsatisfactory - test suspect vehicles.

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Finding representative vehicles

Selected vehicles must:

- Be of a type that is type-approved;
- Have been in-service at least 15,000 km or 6 months and no more than 80,000km or 5 years;
- Have a proper maintenance record;
- Show no signs of abuse, accident damage, tampering or misfuelling;
- Emission system must comply with the type-approval.

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Diagnosis and maintenance

- Diagnosis and any normal maintenance is allowed prior to testing;
- Any defective components in the ignition system are replaced;
- OBD is checked for proper functioning - any fault codes are recorded and repairs carried out;
- Vehicle is filled with test reference fuel or market fuel.

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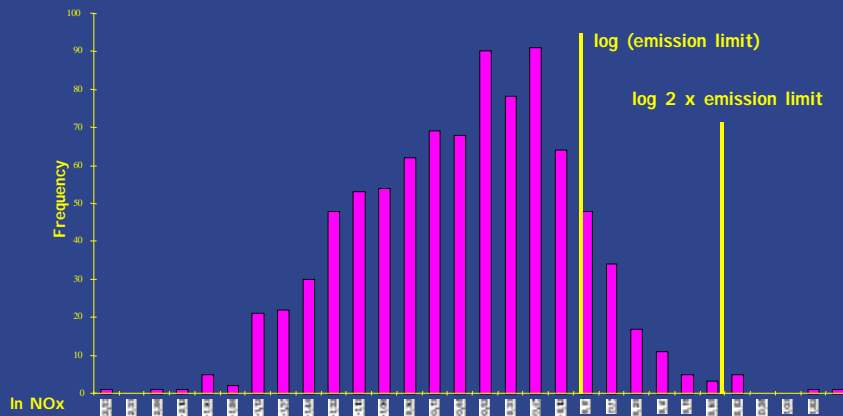
Emission tests

- Full Type I tailpipe emissions test;
- OBD system is checked for proper functioning with respect to the OBD threshold limits;
- OBD is checked for correct malfunction indication when emissions are above the OBD thresholds;
- The vehicle is checked to see if it is an 'outlying emitter'.

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Emission test evaluation

- Procedure first looks for vehicles which may be called an 'outlying emitter', e.g:



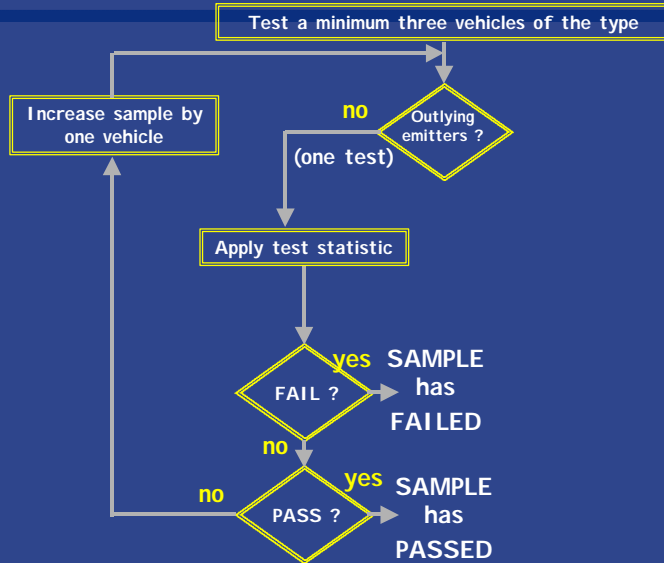
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Sampling by attributes

- One-by-one vehicle emission test - count how many vehicles have an emission over the limit;
- After each inspection, does sufficient information exist to make a PASS or FAIL judgement:
 - must avoid accepting a bad sample;
 - must avoid failing a good sample;
- This procedure was accepted by the Council and the European Parliament for in-use compliance testing.

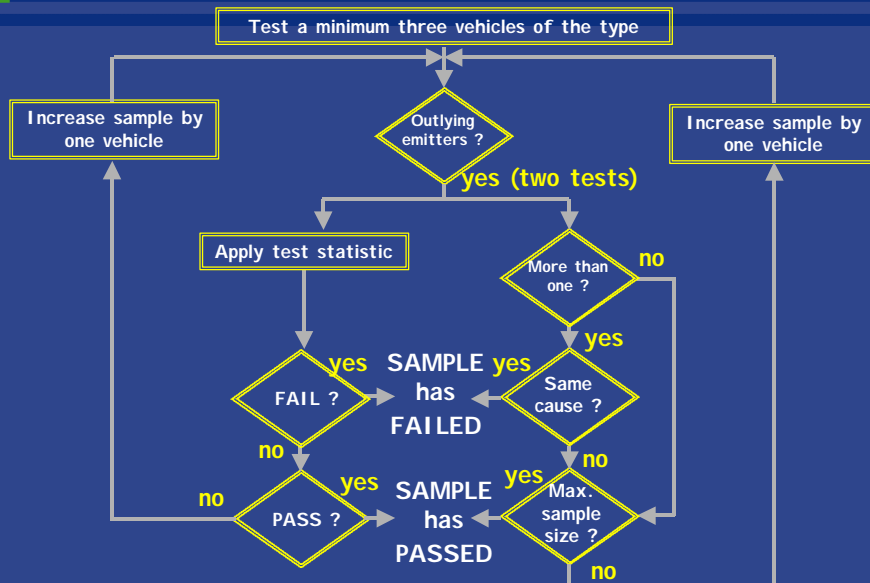
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Vehicle testing - process



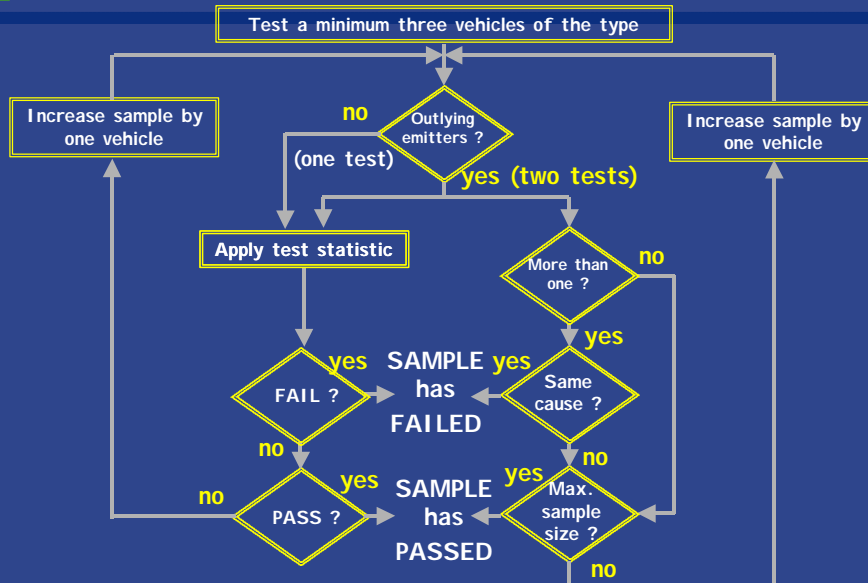
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Vehicle testing - process



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Vehicle testing - process



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If the sample fails...

- Manufacturer must submit plan of remedial measures within 60 working days (longer possible);
- Original approval authority shall approve the remedial plan within a month;
- The remedial plan shall:
 - describe vehicles affected and necessary changes;
 - include all vehicle owner instructions;
 - include all service/repair instructions

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Who can carry out tests ?

- Type-approval authority who granted type-approved;
- Any other Member State may carry out vehicle tests in his own territory;
- If problems are found the original type-approval authority must be informed;
- Type-approval authority has 6 months to act;
- If test data disputed - settlement needed. If test data accepted - manufacturer action.

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Corrective actions

- Within two months of notification, manufacturer must submit plan of remedial measures;
- Original approval authority shall approve the remedial plan within a further two months;
- All other Member States are informed;
- If no agreement can be reached the original approval authority may withdraw type-approval for the affected vehicle type(s).

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Future work

- Overall concept needs to be reviewed;
- Assessment based on gathered data from European in-use conformity data;
- The need for and basis of the outlier definition needs to be further reviewed;
- A statistical plan with a limited sample size and insensitive to outliers would be more efficient;
- Report by end 2002.

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On-board diagnostics (OBD)

- Compares sensed values with a standard calibration to deduce if emissions would exceed a defined threshold;
- Monitors catalyst for efficiency, oxygen sensor, engine misfire and all other emission-related components;
- Offers standardisation for ease of fault diagnosis and repair;
- Applicable to both petrol and diesel vehicles.

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On-board diagnostics (OBD)

- Applicable from 1 January 2000/2001 to new vehicles with positive-ignition engines;
- Applicable from 1 January 2003/2004 to new vehicles with compression-ignition engines;
- Proposal to give gas fuelled vehicles extra time until 2003 was agreed last December;
- Certain OBD system deficiencies allowed.

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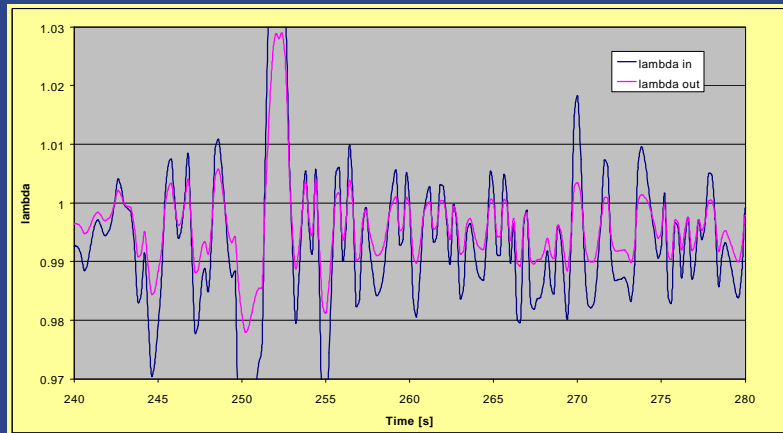
OBD thresholds 2000 →

	CO (g/km)		HC (g/km)		NOx (g/km)		PM (g/km)
	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	Diesel
Cars	3.2	3.2	0.4	0.4	0.6	1.2	0.18
LCV I	3.2	3.2	0.4	0.4	0.6	1.2	0.18
LCV II	5.8	4.0	0.5	0.5	0.7	1.6	0.23
LCV III	7.3	4.8	0.6	0.6	0.8	1.9	0.28

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OBD threshold limits 2005

- OSC index is the ratio of the integrals of the two lambda signals, for the lean periods:



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OBD threshold limits 2005

OSC method:

- Possibility exists for a high number of false alarms, resulting in low system reliability;
- Lowering OBD threshold from the current 0.4 g/km (HC) not recommended;

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OBD threshold limits 2005

Thermal method:

- Returns virtually no false alarms - traces all faulty vehicles;
- Provides more accurate correlation between OBD index and total HC emissions. It is therefore possible to lower the OBD threshold.

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Other issues - OBD

- Replacement catalysts and other replacement parts:
 - to ensure compatibility with OBD-equipped vehicles;
- Access to emission-related repair information:
 - through access to manufacturer web-sites;
 - need to standardise information formatting and information ID for search capability.

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Other current issues

- EEV concept for light duty vehicles:
 - CO₂, N₂O, CH₄;
 - how to set an incentive target for CO₂ ?
 - fuel and technology neutral.
- Modification of Euro IV total HC limits for vehicles using gas fuels.

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Other current issues

- Fuels used for testing:
 - Directive 98/69/EC requires that the 2005 test fuels must reflect market average fuels in 2005;
 - Today, a manufacturer can use a zero sulphur fuel with beneficial PM emission effects;
 - Petrol: aromatics, oxygen and sulphur;
 - Diesel: sulphur.

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Further work - post 2005

- An extension of the durability requirements beyond 100,000 km;
- Requirements for on-board monitoring (OBM) systems;
- Contribution of vehicle technology to attain longer term air quality objectives (health effects of particulates).

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ADDITIONAL TECHNICAL MEASURES FOR HEAVY- DUTY VEHICLES

Directive 1999/96/EC

HDV OBD: Scope

- An engine plus after-treatment diagnostic concept:
 - applicable to new vehicles with compression-ignition engines from 1st October 2005 (Euro IV).

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HDV OBD: Scope

- An engine plus after-treatment diagnostic concept with extension to the vehicle system:
 - there must be a diagnostic interface between the ECU and other vehicle electronic systems that provide an input to or receive an output from the ECU;
 - applicable to new vehicles with compression-ignition engines from 1st October 2008 (Euro V).

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OBD monitoring thresholds

- OBD 'threshold limits' are applicable for diesel engines without after-treatment dealing with either the emission of NO_x or PM;
 - NO_x and PM threshold limits for 2005 and 2008;
 - Based on tailpipe limits of a previous Euro-stage?
 - Are CO or HC threshold limits necessary for diesels?

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OBD monitoring functionality

- Major difficulty to set any appropriate OBD threshold limits for deNO_x and PM traps;
 - uncertainty regarding deNO_x systems - sensor technology?
 - particulate monitoring ? PM trap can be monitored, but only for functionality;
 - Durability needs to be defined;
- Propose to monitor deNO_x and PM traps only for total functional failure.

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OBD monitoring functionality

- Scope of total functional failure of deNOx or PM traps:
 - removal or replacement of systems;
 - lack of reagent for SCR;
 - electrical failure of SCR actuators;
 - major breakdown of NOx trap;
 - major breakdown of PM trap:
 - complete melting;
 - completely clogged filter;

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Further work - post 2005

- Durability:
 - large heavy duty vehicles travel very high distances before major work (circa. 750,000 km);
 - Need reference point for in-use checks;
 - Durability test probably impractical;
- In-use conformity checking:
 - looking to see if OBD can be an effective tool, instead of in-use testing.

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INTERNATIONAL TECHNICAL HARMONISATION

Agreements

- Revised 1958 Agreement of the UN-ECE:
 - Common technical requirements in the motor vehicle sector;
 - European Community acceded in March 1998, Japan November. No USA;
 - Qualified majority voting;
 - UN-ECE Regulations recognised as equivalent and alternative to EU Directives.

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Agreements

- Global Agreement of 1998:
 - Entered into force on 25 August 2000;
 - All major players are parties to the agreement (European Community, Japan, USA...);
 - Unanimity voting;
 - Provides a legal framework for the development of global automotive regulations;

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Areas of common interest

- The Commission and US EPA regularly discuss issues of mutual interest on air quality and motor vehicles;
- Emissions from non-road engines showed the way to a harmonised standard;
- Next steps should be:
 - Particulate size and number;
 - OBD for heavy-duty vehicles;
 - next stages of non-road;
 - fuel quality.

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FUTURE TEST CYCLES

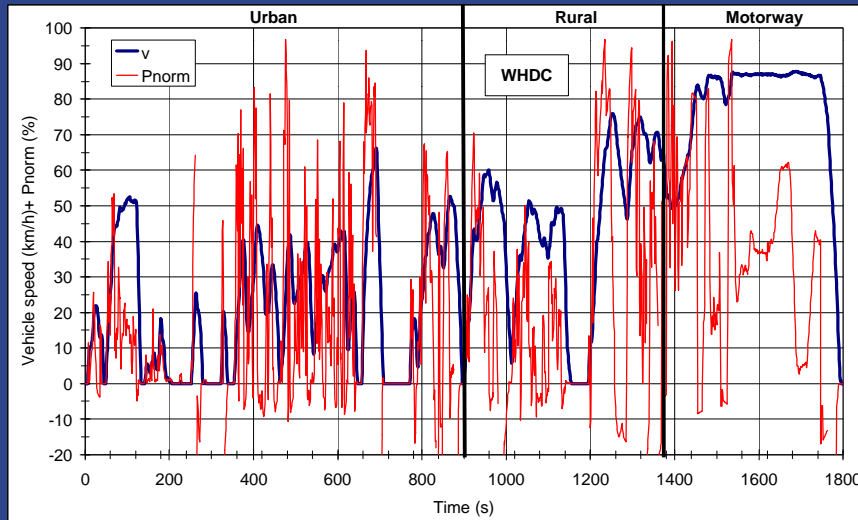
DONE AS GLOBAL HARMONISATION INITIATIVES

World Heavy-Duty Cycle

- Working group (under UN-ECE) developing a world-wide representative test cycle;
- Collect world-wide in-use driving data and statistical data on vehicle use patterns and conditions;
- Develop representative transient cycles for EU, Japan and USA;

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World Heavy-Duty Cycle



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World Heavy-Duty Cycle

- Vehicle test cycle, representative for world use, with transformation algorithm to an engine test cycle;
- 15-mode steady-state test cycle;
- World test cycle was recently presented in Geneva;
- Study criteria for cycle by-pass prevention;
- Next stage will be to validate the cycle on modern engines.

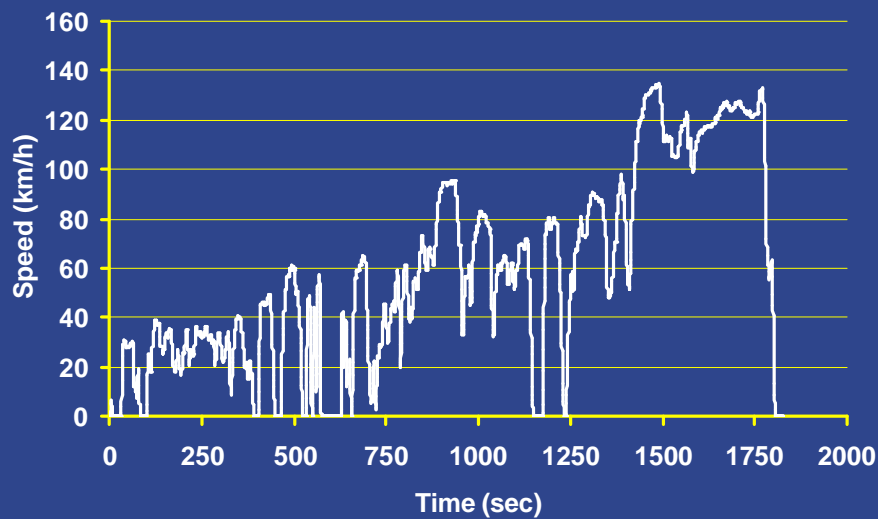
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World Motorbike Test Cycle

- The WMTC programme started in 1999 under a mandate from the UN-ECE in Geneva;
- Support from the EU, Japan, USA and world motorcycle industry;
- Representative 3-part cycle developed now to be validated:
 - cycle feasibility by end Q3 in 2001;
 - round-robin by end Q2 in 2002.

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World Motorbike Test Cycle



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World Motorbike Test Cycle

Proposed application of the WMTC:

- under 150 cc, part 1 only from a cold start;
- 150-450 cc, parts 1 and 2 from a cold start;
- > 450cc, all cycle from a cold start;

Cycle was recently presented in Geneva.

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**CO₂ VOLUNTARY
AGREEMENTS**

CO₂ voluntary agreement

	140 g/km average CO ₂ by:	Sales of 120 g/km CO ₂ models:	Intermediate CO ₂ target range:
ACEA	2008	No later than 2000	165-170 g/km in 2003
JAMA	2009	No later than 2000	165-175 g/km in 2003
KAMA	2009	As soon as possible	165-170 g/km in 2004

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- ## CO₂ voluntary agreement
- In 2003 (KAMA 2004), to review potential for further CO₂ reductions towards 120 g/km average by 2012;
 - Agreement based on 1996 test procedure (with 40 sec);
 - Availability of enabling fuels such as gasoline with maximum 30 ppm sulphur and maximum 30% aromatics and diesel with maximum 30 ppm sulphur and minimum 58 cetane.
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CO₂ voluntary agreement

- No distortions of competition - equivalent CO₂ reduction efforts from other manufacturers;
- Unhampered entry of fuel-efficient technology to the market, e.g. GDI, DI diesel;
- Market availability of fuels for the technology;
- Innovative vehicle concepts counted towards the CO₂ objective, e.g. new propulsion systems, alternative fuels.

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CO₂ voluntary agreement

- Commission will report annually to the Council and the European Parliament on the implementation of the agreement and progress of average CO₂ emissions;
- Member States data on new vehicles, ACEA market average figure;
- Labelling information, e.g. at point of sale, to enable consumer choice.

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CO₂: remaining issues

- Clarify impact of new test cycle (deleted 40 sec) on CO₂ emissions and attainment of the agreement;
- Extension of fuel consumption and CO₂ measurement to (loaded) light commercial vehicles;
- Level playing field - definition of vehicle 'mass' for emission and CO₂ testing.

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Conclusions

- In-Use Conformity Testing and OBD will enhance vehicle emission compliance in-use;
- Now studying similar measures for HDV plus durability;
- Further technical measures have potential for international harmonisation.

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