

## **“Chemical and Physical Characterization of Particle Vehicle Emissions”**

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## Motorcycles and air quality

In 1995, motorcycles accounted for some 6.7% CO, 4.3% HC and 0.2% NO<sub>x</sub> of total road transport emissions.

Tendencies:

- ✉ Their relative share is rising due to restricting measures for other types of vehicles.
- ✉ The mopeds and motorcycles contribute mainly to urban air pollution
- ✉ The emissions of large motorcycles are significant in warm ozone-sensitive summer weekends.

*(Source: P. Greening, EC-DG ENTR)*



## Policy relevance:

### Directive 97/24/EEC

MOTORCYCLE EMISSIONS LIMITS (g/km)						
	PM	NOx	HC	CO	HC+NOx	TEST CYCLE
Euro 1 - 1999 (2 STROKE)	-	0.10	4	8		4*UDC
Euro 1 - 1999 (4 STROKE)	-	0.30	3	13		4*UDC
Euro 2 - 2003 (2 & 4 STROKE)	-	0.30	1.20	5.50		4*UDC
<b>Euro 3 - 2006</b>	<b>TBD</b>	<b>TBD</b>	<b>TBD</b>	<b>TBD</b>		<b>TBD</b>
LIGHT DUTY GASOLINE EMISSIONS LIMITS (g/km)						
Euro 2 - 1996	-	-	-	2.20	0.50	4*UDC+EUDC
Euro 3 - 2000	-	0.15	0.20	2.30		4*UDC+EUDC (*)
Euro 4 - 2005	-	0.08	0.10	1.00		4*UDC+EUDC (*)
LIGHT DUTY DIESEL EMISSIONS LIMITS (g/km)						
Euro 2 - 1996	0.080	-	-	1.06	0.71	4*UDC+EUDC
Euro 3 - 2000	0.050	0.50	-	0.64	0.56	4*UDC+EUDC (*)
Euro 4 - 2005	0.025	0.25	-	0.50	0.30	4*UDC+EUDC (*)

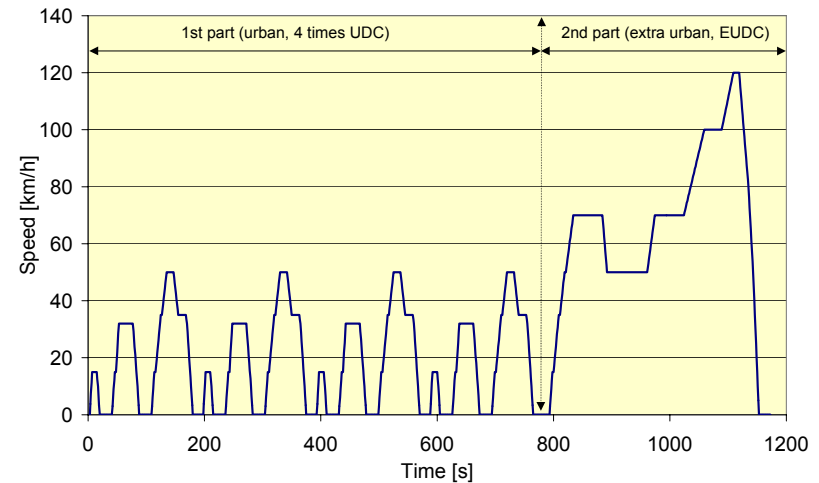
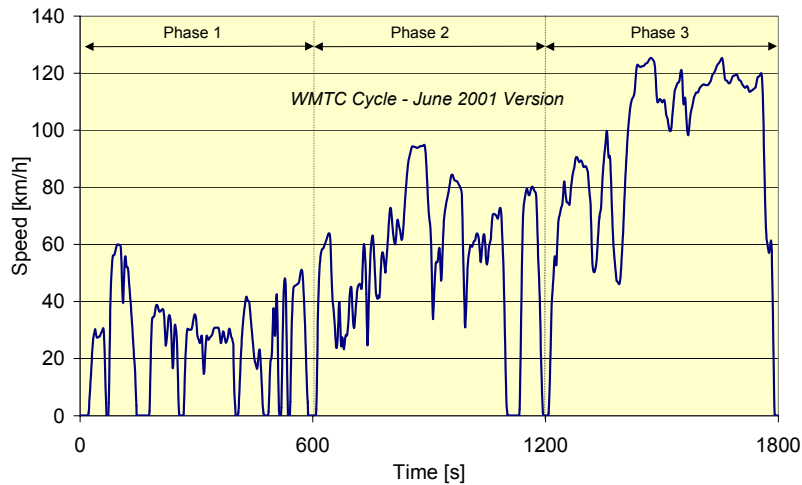
(\*) Emissions sampling starts from "key on" cycle without 40 seconds of idling  
 "TBD" = To Be Decided, Commission's proposal needed by the end of 2002.

- > Next amendment foreseen for 2006 (EURO3 stage), with possible new limits, new cycle and new classification.
- > New stringency to be comparable to EURO3 cars.

## Main issues for the 2006 EURO3 Directive

### 1. Driving cycle to be applied

- > World wide harmonised Motorcycle Test Cycle (WMTC) (Under development)?
- > Derivative of the passenger car ECE cycle?
- > Corresponding emissions limits?



### 2. The particulate limits for 2-stroke engines and the associated measurement techniques.

## Motorcycle Selection Matrix

- *Motorcycle types & Emissions reduction technologies*
- *Classes according to WMTC criterion (based on power to mass ratio)*

Class			2-Stroke		4-Stroke			Catalyst		Proposed Motorcycle
	EURO1	EURO2	CB	2SDI	CB	SAI	4SDI	OXC	TWC	
1 (<50 cc)		X	X					X		MBK CW50
2	X									PiaggioHexagon 125
3		X					X	X		Ducati ST4s
3							X			Ducati ST4s (**)
1 (>50 cc)		X		X						Aprilia SR50 DITECH
1 (>50 cc)		X	X					X		-
2		X					X		X	BMW C1?
2		X								-
3		X				X			X	-
3		X					X		X	-

Selection Matrix for Motorcycles ("X" indicate the standards and technologies that are or should be present on tested motorcycles)

'CB' = Carburettor (Current baseline technology)

'2SDI' = Two-stroke electronic injection

'4SDI' = Four-stroke electronic injection

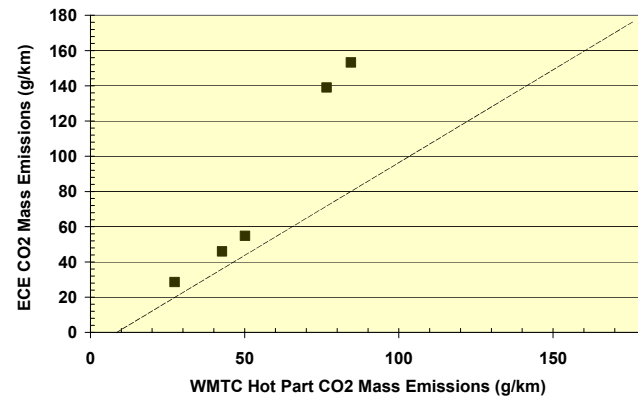
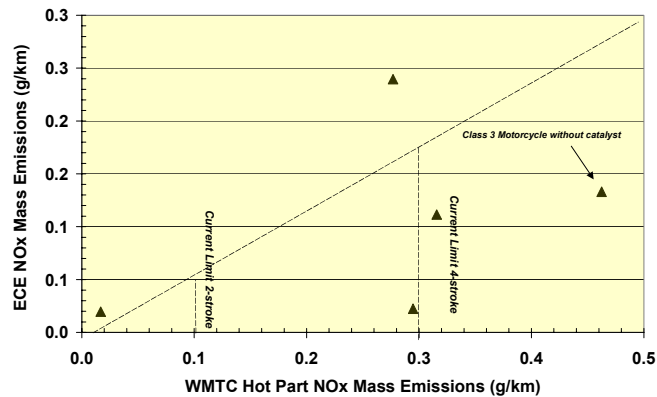
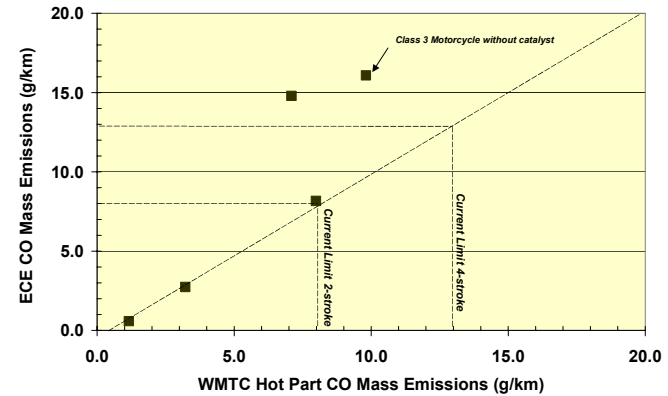
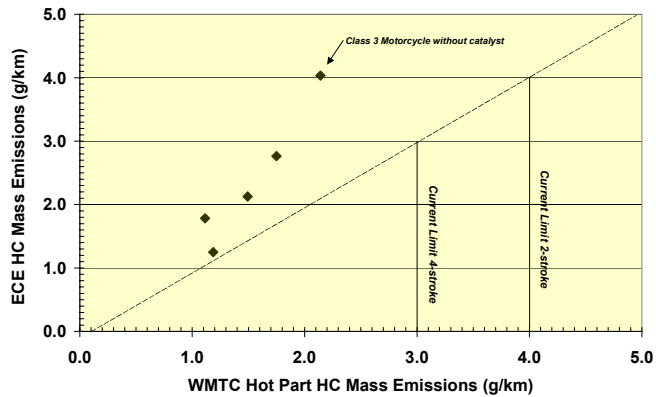
'SAI' = Secondary Air Injection

'OXC' = Oxidation Catalyst

'TWC' = Three Way Catalyst

(\*\*) To check catalyst efficiency

## Effect of driving cycles on emissions



*(Phase 1 of the Worldwide Motorcycle Test Cycle (WMTc) Project)*

### Motorcycle fleet



*(Phase 1 of the Worldwide Motorcycle Test Cycle (WMTC) Project)*

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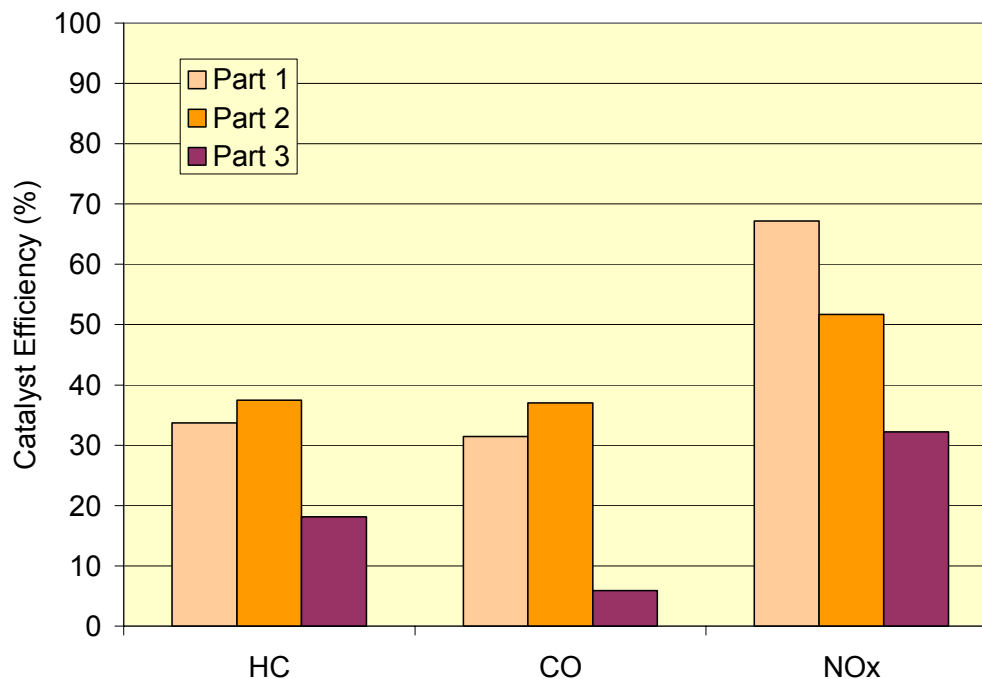
## Testing



*(Phase 1 of the Worldwide Motorcycle Test Cycle (WMTC) Project)*



## Effect of technology on emissions (Catalyst efficiency)



*(Parts 1, 2, 3 are the three different parts of the WMTTC cycle)  
(Phase 2 of the Worldwide Motorcycle Test Cycle (WMTTC) Project)*

## Objectives of the 2002 and beyond JRC Testing Programme

1. Comparison of motorcycle emissions for the two cycles (WMTC and ECE) in order to propose equivalent emissions limits based on the WMTC;
2. Evaluation of particulate measurement techniques for two stroke engines;
3. Assessment of particulate emissions for a limited number of four-stroke engines to check if they diverge significantly from passenger cars.