

## Proposed New Emissions Standards for Two-and Three- Wheeled Vehicles in Europe

The European Commission has proposed new emissions standards for two- and three-wheeled powered vehicles and quadricycles, collectively termed L-category vehicles, as part of a broader regulation that would also cover safety and market surveillance.

From an air-quality perspective the primary objective is to keep constant or reduce the share of total road-transport emissions from L-category vehicles as compared to other road vehicle categories. The proposed regulation would amend several aspects of the type-approval framework currently in place. Specifically, it would:

- Revise and expand the vehicle categories and types covered to match the range of vehicles currently offered on the market. For example, the proposal explicitly covers hybrid vehicles. (See annex 1 for a summary table of the proposed categories.)
- Separately defines emissions limit steps for motorcycles (Euro 4, 5, and 6 ) and all other L-category vehicle types (Euro 3, 4, 5). The Euro 6 limits for motorcycles and Euro 5 limits for all other categories would match the nominal values of passenger-car Euro 5 limits. The standards for motorcycles, passenger tricycles, and heavy on-road quadricycles would be based on the World Motorcycle Test Cycle (WMTC), used as an alternative cycle under current emissions regulations.
- Introduce durability requirements and deterioration factors for all vehicle types and emission levels.
- Require on-board diagnostic (OBD) technologies for new L-category vehicles, following an implementation schedule that would depend in part on the results of an impact assessment planned for 2016.
- Require reporting of carbon dioxide (CO<sub>2</sub>) emissions as part of the type approval process.

The proposal will go to the European Parliament and the European Council for approval in early 2011. If approved the regulation would go into effect by 1 January 2013.

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### Context

In 2008, 31.3 million powered bicycles, mopeds, scooters, and motorcycles were in circulation in the EU27. These powered two-wheelers (PTW) make up the largest share of L-category vehicles, and mopeds account for about 40% of all PTW<sup>1</sup>. Emissions inventory projections show that without the proposed new standards, the share of on-road transport hydrocarbon (HC) emissions attributable to L-category vehicles will increase from 38% in 2007 to 62% in 2020<sup>2</sup>. The projected increase in the proportion of HC emissions from L-category vehicles is in part due to increasingly stringent emission standards for passenger cars, commercial vehicles, and heavy-duty vehicles.

### Key Elements of the Proposed Program

**Scope.** The proposed regulation applies to the type-approval and individual approval of all new two- and three-wheeled vehicles and quadricycles intended for travel on public roads. The new proposal expands the number of L-category vehicle types to seven, with sixteen subcategories, defined according to engine displacement, maximum speed, and rated power. It subdivides the two-wheeler category used in existing standards into two subcategories, namely light two-wheel powered vehicles (powered bicycle and mopeds) and two-wheel motorcycles. The proposal contemplates specific emission levels for each L-subcategory vehicle. A description of each category and subcategory is presented in Annex 1.

**Pollutants.** The proposal would set more stringent emission standards for hydrocarbons, carbon monoxide, nitrogen oxides (NOx) and particulate matter (PM). Three emission limits steps are defined: Euro 4, 5, and 6 for motorcycles; Euro 3, 4, and 5 for all other L-category vehicles. (Current emission limits for motorcycles are labeled Euro 3, for mopeds and other L-category vehicles Euro 2.) The new limit steps would go into effect in 2014, 2017 and 2020.

The Euro 5 emission limits for L-category vehicles and Euro 6 limits for motorcycles have the same nominal values as the Euro 5 emission limits for passenger cars (M1). For motorcycles with a maximum design speed of 130 km/h, the proposed Euro 4 limits for HC, CO and NOx are 1.97, 0.56 and 0.13 g/km respectively, representing a 25% reduction for each pollutant from current Euro 3 limits. By 2017 and 2020, HC limits for motorcycles would fall 50% and 87% from current levels; CO and NOx limits would fall 57% and 62%. Table 1 shows the proposed timeline and emission limits for each subcategory of vehicles.

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1 ACEM. "The Motorcycle Industry in Europe." Association des Constructeurs Européens de Motocycles. 2010. <<http://www.acem.eu/cms/marketfigures.php>> (accessed 2010).

2 Ntziachristos, L., S. Geivanidis, Z. Samaras, A. Xanthopoulos, H. Steven, and B. Bugsel. "Study on Possible New Measures Concerning Motorcycle Emissions." Mechanical Engineering Department, Aristotle University Thessaloniki, 2009.

Table 1. Proposed tailpipe emission limits after cold start

Dates	Vehicle category	Vehicle cat. description	Test cycle	Propulsion class	CO (g/km)	THC (g/km)	NOx (g/km)	PM (g/km) <sup>(5)</sup>	THC+NOx (g/km)
<b>Euro 3<sup>(1)</sup></b>									
NV: 01 July 2013 (Optional) 01 Jan 2014 (Obligatory) AV: 01 Jan 2015 (Obligatory)	L1Ae	Powered cycle <sup>(4)</sup>	UNECE R47	PI/CI/Hybrid	0.56	0.10	0.13	-	-
	L1Be	Two-wheel moped		PI/CI/Hybrid	1.00	-	-	-	1.20
	L2e	Three-wheel moped		PI/CI/Hybrid	3.50	-	-	-	1.20
	L3e <sup>(1)</sup> L4e L5Ae L7Ae	• Two-wheel motor-cycle w and w/o sidecar • Tricycle • Heavy on-road quad	WMTC, phase 2	PI, $V_{max} < 130$ km/h	1.97	0.56	0.13	-	-
				PI, $V_{max} \geq 130$ km/h	1.97	0.25	0.17	-	-
				CI/ Hybrid	1.00	0.10	0.57	0.10	-
	L5Be	Commercial tricycle	UNECE R40	PI	4.00	1.00	0.25	-	-
				CI/ Hybrid	1.00	0.15	0.65	0.10	-
	L6Ae L6Be	Light on-road quadricycle Light mini-car	UNECE R47	PI	3.50	-	-	-	1.20
				CI/ Hybrid	1.00	0.15	0.65	0.10	-
L7Be	Heavy mini-car	UNECE R40	PI	4.00	1.00	0.25	-	-	
			CI/ Hybrid	1.00	0.15	0.65	0.10	-	
<b>Euro 4<sup>(2)</sup></b>									
NV: 01 Jan 2015 (Optional) 01 Jan 2017 (Obligatory) AV: 01 Jan 2018 (Obligatory)	L1Ae	Powered cycle	UNECE R47	PI/CI/Hybrid	0.56	0.10	0.07	-	-
	L1Be	Two-wheel moped		PI/CI/Hybrid	1.00	0.63	0.17	-	-
	L2e	Three-wheel moped		PI/CI/Hybrid	1.90	0.73	0.17	-	-
	L3e <sup>(2)</sup> L4e L5Ae L7Ae	• Two-wheel motor-cycle w and w/o sidecar • Tricycle • Heavy on-road quad	WMTC, phase 2	PI, $V_{max} < 130$ km/h	1.14	0.38	0.07	-	-
				PI, $V_{max} \geq 130$ km/h	1.14	0.17	0.09	-	-
				CI/ Hybrid	1.00	0.10	0.30	0.08	-
	L5Be	Commercial tricycle	UNECE R40	PI	2.00	0.55	0.25	-	-
				CI/ Hybrid	1.00	0.10	0.55	0.08	-
	L6Ae L6Be	Light on-road quadricycle Light mini-car	UNECE R47	PI	1.90	0.73	0.17	-	0.08
				CI/ Hybrid	1.00	0.10	0.55	0.10	-
L7Be	Heavy mini-car	UNECE R40	PI	2.00	0.55	0.25	-	-	
			CI/ Hybrid	1.00	0.10	0.55	0.10	-	
<b>Euro 5<sup>(3)</sup></b>									
NV: 01 Jan 2018 (Optional) 01 Jan 2020 (Obligatory) AV: 01 Jan 2021 (Obligatory)	L1Ae	Powered cycle	Revised WMTC	PI /CI/ Hybrid	0.50	THC 0.010 NMHC 0.068	0.060	0.0045	-
	L1Be- L7e <sup>(3)</sup>	All other L-category vehicles	Revised WMTC	PI	1.00		0.060	0.0045	-
			Revised WMTC	CI / Hybrid	0.50		0.060	0.0045	-

(1) Category L3e: Euro 4

(2) Category L3e: Euro 5

(3) Category L3e: Euro 6

(4) Bicycle with auxiliary engine

(5) PM measured in CI engines or in hybrids with CI engines

NV: New vehicle

AV: All vehicles

NMHC: Non-methane hydrocarbon.

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**On-board diagnostic systems.** For all L-vehicle categories, the proposed regulation initially requires OBD technologies that provide minor malfunction monitoring (e.g., circuit integrity) as well as access to repair and maintenance information, but no catalyst efficiency and misfire monitoring. OBD-1, as that initial stage is termed, would take effect in January 2017 for mopeds, motorcycles, and three-wheelers. A second-stage requirement will be considered upon completion of an environmental study planned for 2016, which will evaluate the impact of the proposed measures. OBD-2 would cover complete failures and deterioration of systems. Threshold limits for HC, CO and NOx are specified in the proposed regulation for OBD-1 and OBD-2.

**Durability.** Manufacturers would have to ensure that type-approved vehicles meet the environmental requirements over vehicle life. Durability test and deterioration factors are proposed as part of enhancements to the test procedures (Table 2).

Table 2. Proposed durability and deterioration factors (DF)

Vehicle category	Vehicle category description	Euro 3 <sup>(1)</sup>				Euro 4 <sup>(2)</sup>				Euro 5 <sup>(3)</sup>			
Durability		km				km				km			
L1Ae	• Powered cycle	5000				5500				6000			
L1Be L2e L6Ae	• Two-wheel moped • Three-wheel moped • Light on-road quad.	10000				11000				12000			
L3e L4e L5e L6Be L7Be	• Two-wheel motorcycle ( $V_{max} < 130$ km/h) w/ and w/o side-car • Tricycle • Light mini-car • Heavy mini-car	18000				20000				30000			
L3e L4ev <sup>(14)</sup> L7Ae	• Two-wheel motorcycle ( $V_{max} \geq 130$ km/h) w and w/o side-car • Heavy on-road quadricycle	30000				35000				50000			
Deterioration factors		DF				DF				DF <sup>(4)</sup>			
		CO	HC	NOx	PM	CO	HC	NOx	PM	CO	THC <sup>(5)</sup>	NOx	PM
All L1e-L7e	PI	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.5	1.3	1.3	-
	CI									1.5	1.1	1.1	1.0

(1) Category L3e: Euro 4

(2) Category L3e: Euro 5

(3) Category L3e: Euro 6

(4) Definitive values depend on a proposed environmental study scheduled by January 2016.

(5) THC and NMHC have the same DF values

## Greenhouse gas emissions and fuel consumption

The proposal would require CO<sub>2</sub> emissions measurement and reporting for type approval. However, no CO<sub>2</sub> emission limits or fuel economy levels are proposed. CO<sub>2</sub> emission and fuel consumption data would be provided to the buyer of a new vehicle at the time of purchase. Data collected from CO<sub>2</sub> emissions and derived fuel consumption would be used to define an energy-efficiency labeling scheme similar to that used for passenger cars. Specific CO<sub>2</sub> emission measurement and fuel consumption calculations or measurement methods will be proposed later.

## Annex 1. Type-L vehicle categories and description

Category	Category name	Classification criteria
L1Ae	Light 2-wheel powered vehicle	<ul style="list-style-type: none"> <li>• Engine aids pedaling of vehicle</li> <li>• Engine <math>V_d \leq 50</math> cc</li> <li>• <math>V_{max} \leq 25</math> km/h</li> <li>• No aux. propulsion above <math>V_{max}</math></li> <li>• <math>P_{max,cont} \leq 1</math> kW <sup>(1)</sup></li> </ul>
L1Be	2-wheel moped	<ul style="list-style-type: none"> <li>• <math>V_{max} \leq 25</math> km/h</li> <li>• <math>P_{max,cont} \leq 4</math> kW</li> </ul>
L2e	3-wheel moped	<ul style="list-style-type: none"> <li>• Engine <math>V_d &gt; 50</math> cc</li> <li>• <math>V_{max} \leq 45</math> km/h</li> <li>• <math>P_{max,cont} \leq 4</math> kW</li> </ul>
L3e –A1	2-wheel motorcycle Low performance	<ul style="list-style-type: none"> <li>• Engine <math>50 &lt; V_d \leq 125</math> cc</li> <li>• <math>V_{max} &gt; 45</math> km/h</li> <li>• <math>4 &lt; P_{max,cont} \leq 11</math> kW</li> <li>• power/weight <math>\leq 0.1</math> kW/kg</li> </ul>
L3e –A2	2-wheel motorcycle Medium performance	<ul style="list-style-type: none"> <li>• Engine <math>V_d &gt; 50</math> cc</li> <li>• <math>V_{max} &gt; 45</math> km/h</li> <li>• <math>4 &lt; P_{max,cont} \leq 35</math> kW</li> <li>• power/weight <math>\leq 0.2</math> kW/kg</li> </ul>
L3e –A3	2-wheel motorcycle High performance	Any other L3e category motorcycle
L5Ae	Tricycle	<ul style="list-style-type: none"> <li>• Engine <math>V_d &gt; 50</math> cc</li> <li>• <math>V_{max} &gt; 45</math> km/h</li> <li>• <math>P_{max,cont} &gt; 4</math> kW</li> </ul>
L5Be	Commercial tricycle	<ul style="list-style-type: none"> <li>• Engine <math>V_d &gt; 50</math> cc</li> <li>• <math>V_{max} &gt; 45</math> km/h</li> <li>• <math>P_{max,cont} &gt; 4</math> kW</li> <li>• Open and Enclosed driver and passenger (2• 4 people including driver)</li> <li>• Carriage of goods (bed area &gt; 30% of vehicle length times width)</li> </ul>
L6Ae	Light quadricycle	<ul style="list-style-type: none"> <li>• Engine <math>V_d \leq 50</math> cc</li> <li>• <math>V_{max} \leq 45</math> km/h</li> <li>• <math>P_{max,cont} \leq 4</math> kW</li> <li>• Mass <math>\leq 350</math> kg (not including weight of gaseous fuel tanks)</li> </ul>
L6Be	Light mini-car	<ul style="list-style-type: none"> <li>• Engine <math>V_d \leq 50</math> cc</li> <li>• <math>V_{max} \leq 45</math> km/h</li> <li>• <math>P_{max,cont} \leq 6</math> kW</li> <li>• Mass <math>\leq 350</math> kg (not including weight of gaseous fuel tanks)</li> <li>• Enclosed driver and passenger (2 people including driver)</li> <li>• Carriage of goods (bed area &gt; 30% of vehicle length times width)</li> </ul>
L7Ae	Heavy on-road quadricycle	<ul style="list-style-type: none"> <li>• <math>V_{max} &gt; 45</math> km/h</li> <li>• <math>P_{max,cont} \leq 15</math> kW</li> <li>• Mass <math>\leq 400</math> kg for passengers (w/o including weight of gaseous fuel tanks)</li> <li>• 2 people max (Includes passenger)</li> </ul>
L7Be	Heavy mini-car	<ul style="list-style-type: none"> <li>• <math>V_{max} &gt; 45</math> km/h</li> <li>• <math>P_{max,cont} \leq 15</math> kW</li> <li>• Mass <math>\leq 400</math> kg for passengers</li> <li>• Mass <math>\leq 500</math> kg for goods (w/o including weight of gaseous fuel tanks)</li> <li>• Enclosed driver and passenger (2• 4 people including driver)</li> <li>• Carriage of goods (bed area &gt; 30% of vehicle length times width)</li> </ul>

See the proposal's impact assessment for illustrations of L-category vehicles.<sup>3</sup>

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<sup>3</sup> <[http://ec.europa.eu/enterprise/sectors/automotive/files/projects/report\\_measures\\_motorcycle\\_emissions\\_en.pdf](http://ec.europa.eu/enterprise/sectors/automotive/files/projects/report_measures_motorcycle_emissions_en.pdf)> (accessed 2010).