FEMA Response

EC PAPER *REDUCTION OF ENERGY USE IN TRANSPORT*, 2006

9th November, 2006

The Federation of European Motorcyclists' Associations (FEMA) would like to comment the EC Paper on reduction of energy use in transport produced by Group of Expert in 2006.

Introduction

Reduction of Energy Use in Transport has been produced by a Working Group comprising 15 specialists from EU Member States. A lengthy paper comprising 126 pages, it deals with both freight and passenger transport and their impact on the environment with the emphasis on CO_2 emissions. Although drafted by experts, some of the assertions and recommendations on motorcycles not only demonstrate an ignorance of motorcycling technicalities but also lack of basic automotive knowledge. With the exception of one specific section and a summary of recommendations in the annex all other statistics and references to motorcycles include them with cars and vans.

Modal shift

It is significant that the paper only deals with motorcycles as a problem regarding their fuel efficiency and completely overlooks their positive contributions in the section on modal shift. It fails to consider the role that PTWs can play as an alternative mode of transport and it fails better integrate them into the transport mix. On the other hand, walking, cycling and public transport are cited as desirable modes and given extensive consideration. The paper refers to the average occupancy of cars in European cities as 1.2 persons which is unchanged from the EC Green Paper of 1992 demonstrating little progress in encouraging car sharing. Hence if so many cars are subject to single occupancy, a modal shift to motorcycles would bring about not only a reduction in congestion and demand for land use (roads and parking) but would bring about a reduction in fuel consumption and CO_2 emissions. Motorcycles' role in addressing social exclusion has also been ignored.

Motorcycle Fuel Efficiency

This subject is dealt with in *Section IV.4 Increase of technical unit efficiency: motorcycles* and *Documentation sheet (23)* which summarises the recommendations. *Section IV.4* makes a number of statements about pollutant emissions of motorcycles and fuel efficiency where many fail to consider current motorcycle design, standards existing prior to the introduction of Euro 3 emissions limits and the use to which motorcycles are put, such as in congested conditions where by making better progress than vehicles subject to intermittent movement, motorcycles' fuel efficiency is comparatively enhanced.

We agree that there is a strong case to improve motorcycles' fuel consumption and commensurate CO_2 emissions and advocate putting pressure on motorcycle manufacturers to do so. While many motorcyclists are not unduly concerned about this issue, they would benefit and help to safeguard the future. It was apparent that the paper fails to cite the negative effects of anti-pollution measures on fuel efficiency. Nevertheless, improvements should be possible without unduly sacrificing useable performance which manufacturers should take on board, particularly for their utilitarian motorcycles and scooters.

The paper is ambiguous in claim that the fleet of motorcycles in Europe is 'rather big'. If the suggestion is that the circulating parc is large, then this is completely untrue since motorcycles comprise a relatively small proportion of the traffic mix. If it means that motorcycles in the circulating parc tend to be 'rather big' resulting in low efficiency and high air pollution the question of size and efficiency can also be refuted. To deal with pollution first, motorcycles in the European Union have been subject to Type-Approval since July 1999 which includes pollutant emissions limits. Since then, all motorcycles on sale in the EU have been subject to Euro 2 limits from July 2003 and Euro 3 (equivalent to catalyst equipped cars) since January, 2006. Pollutant emissions controls such as air injection and simple catalytic converters to encourage complete combustion have, therefore been used on motorcycles for some time with closed loop catalytic converters employed on some models by manufacturers anxious to pre-comply. 'Big' does not equate with efficiency or fuel consumption since some of the larger machines are predominantly operated well within their performance envelope. The engine displacement of motorcycles is less relevant to fuel consumption than the state of tune. A large engine with a broad power band tends to be more efficient than a smaller engine producing more power at the higher end of the rev range. The claim that power and performance levels are not acceptable is again not accurate since as previously stated, the manner in which the power is delivered is more significant and the rider having a choice on whether to use a motorcycle's full performance potential.

There is also a statement that there is 'some hope that Euro 3 motorcycles with catalytic converters run with leaner air fuel ratios and thus have lower fuel consumption' which is completely erroneous. Simple oxidising catalytic converters have little effect on fuel consumption save for slightly increased back pressure in the exhaust systems. They are able to cope with lean air fuel ratios and ensure complete combustion eliminating Carbon Monoxide (CO) and unburnt hydrocarbons (HC) with post-combustion air injection aiding the process. However, Euro 3 limits require oxides of Nitrogen to undergo a reducing reaction to produce oxygen and nitrogen as well as ensuring the oxidation of CO and HCs. Closed loop catalytic converters are usually necessary in which the fuel management system provides a stoichiometric mix so that all the components react to completion producing oxygen, nitrogen, CO_2 and water vapour. A lean mix would produce oxides of nitrogen from the nitrogen and oxygen in air reacting at high temperatures. Hence emissions controls using closed loop catalytic converters will militate against lower fuel consumption. Anecdotally, some of the motorcycles using closed loop catalytic converters have significantly higher fuel consumption than the models they replaced.

A number of measures are recommended, most of which are inappropriate.

- **Well-tuned carburettors or – better – direct injection for exact fuel dosing.**

  The vast majority of motorcycles produced today use fuel injection in place of carburettors since it is inherently more efficient, remains in adjustment and can be precisely mapped electronically. Direct injection (presumably into the cylinder) is not common with motorcycles, readily achievable or desirable as a means of increasing efficiency with the usual practice being the injection of fuel into the inlet tract. There is a case for using the most sophisticated fuel injectors which better atomise the fuel for more efficient combustion and a smoother throttle response. Some 2-stroke engines use direct injection into the crank case.

- **Only 1-cylinder engines for an exactly harmonised air fuel ratio.**

With fuel injection and, to a lesser extent, carburettors, there is not a problem in balancing the fuelling of multi-cylinder engines. With individual carburettors or fuel injectors for each cylinder, they act as multiple single-cylinder units. Single cylinder units were traditionally regarded as having economical fuel consumption but this was due to a long stroke and a heavy flywheel which had the effect of reducing their throttle response. Modern singles use a shorter stroke and lighter flywheels for improved acceleration which is desirable for rideability. As well as the reduction of efficiency through increased weight from heavy flywheels and large pistons, air is often trapped in a single's crank cases requiring a breather system and more energy losses. Multi-cylinder layouts can provide better efficiency than singles without the problem of trapped air through constant volumes in crank cases while maintaining a better throttle response.

- **Use of 4-stroke engines, because of the scavenging losses by 2-stroke engines.**

Only a limited number of motorcycles in the circulating parc use 2-stroke engines. They tend to be in the smallest categories which enjoy low fuel consumption where pollutant emissions are controlled by simple catalytic converters and synthetic oils to limit particulate emissions. Their simplicity provides the best balance between cost of manufacturing and efficiency of use for such small engines. There is an ongoing process where 4-strokes continue to supersede 2-strokes even for smaller capacity engines. The poor scavenging referred to is more of a pollution control issue rather than one of efficiency but all new motorcycles comply with Euro 3 limits regardless of their engine cycle. Hence this recommendation is superfluous.

- **Automatic transmission for reasonable gear changing to avoid increased fuel consumption (and noise) in consequence of strong acceleration**

The ability of a motorcycle to accelerate rapidly is a positive safety aid which should not be sacrificed so the advice should be for riders to use rapid acceleration less routinely and primarily when necessary. With EC Type-Approval limits and regulations on aftermarket exhaust systems, motorcycles are not inherently loud and some suggestions from EC and UN ECE committees about reducing noise levels from legal motorcycles should be resisted. Automatic transmission is generally less efficient than conventional gears and chain drive and remains less efficient in continuous while poor gear selection is transient. The use of belts on variable pulleys is relatively efficient and lends itself well to scooters. However, automatic scooters have been shown to be less fuel efficient than conventional motorcycles of similar capacities. In addition, the design of motorcycles may not be as suitable for the use of this system and require automatic gearboxes which are subject to greater power (and efficiency) losses. Riders should retain the option of manual transmission which is very efficient using the tried and tested positive stop gear change mechanism.

- **Not more than 650 cm^3 cylinder capacity**

We question the basis on which this figure was selected since it is not the most common engine capacity. The most popular sports bikes and all-rounders are nominally 600 cc although some of the super moto and adventure sport single cylinder machines are of this capacity. It is worth noting that single cylinder super motos are regarded as somewhat impractical with little carrying capacity, poor fuel consumption and requiring extensive maintenance. The issue in relation to fuel consumption is one of power and how that power is delivered rather than capacity with basic 1000 cc – 1200 cc machines with relatively modest power outputs often returning better fuel consumption than highly tuned sports 600 cc motorcycles. The weight of motorcycles can also be a factor in which the larger scooters are not as efficient as they should be.

There is a reference to Euro 3 emissions limits bringing with them 'the common driving cycle'. At present motorcycles are subject to the Modified Car Test Cycle. This is to be superseded by the World Motorcycle Test Cycle which, I understand, is still being refined which will be a more accurate representation of motorcycle use.

The paper advocates the introduction of 'CO_2 limits for motorcycles graduated according to motorcycle classes (e.g.: mopeds, 50 – 169cm^3, 170 – 269cm^3, 280cm^3 and above)' in order to 'break the motorcycle trend towards more power, speed and acceleration.' While a system of road tax based upon CO_2 emissions as advocated in the following section on cars and light duty vehicles would appear to fair, we question the need for including them in engine capacities. In addition, the categories suggested bear no resemblance to any existing systems such as noise, licensing or national taxation categories which use motorcycle capacities.

Document sheet (23) of the paper raises some other issues not covered above.

It requires CO_2 limits to be applied to reduce consumption and power. Power should not be limited but better efficiency encouraged. In addition, the real-world use of motorcycles, particularly in congested conditions where they are used more efficiently than vehicles subject to intermittent movements should be taken into account.

There is a call for lower NO_X emissions but this has already been addressed by the Euro 3 limits.

The document claims that lower performance can reduce accident/casualty rates when all the available evidence indicates that the larger more powerful motorcycles are, if anything, under-represented in casualty statistics. It is inaccurate to claim that downsizing will have a beneficial effect on safety, the environment and energy use.

Technology to achieve these aims is claimed to be available and cost effective. Yet, how does reducing motorcycles' capacity and performance involve any technology?

The paper acknowledged that there will be heavy resistance from the motor industry and lobby. With the case so poorly argued and the plethora of technical errors on which the arguments are based, it is not difficult to refute.

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The Federation of European Motorcyclists' Associations

The Federation of European Motorcyclists' Associations (FEMA) is the representative federation of motorcycle (comprising all powered two-wheeled vehicles) users throughout Europe. FEMA represents the interests' of citizens' national organisations at the European Union and agencies of the United Nations. FEMA's primary objective is to pursue, promote and protect the interests of motorcyclists. FEMA recognises that motorcycles have different characteristics from other vehicles and emphasises the need for motorcyclists' specific requirements to be addressed.