Vehicle Design & Research

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Comments on research into Daytime Running Lights (DRLs)

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In 2005 I prepared a paper for the International Conference on the Enhanced Safety of Vehicles (ESV) that recommended bright yellow front turn signals be used as daytime running lights on motorcycles (http://tinyurl.com/65fdcb). The research combined accident studies, photometric analysis and traffic design practices to show that low beam headlights were only marginally effective as DRLs (a possible explanation for the so-called latitude effect), that dedicated bright white or yellow DRLs were the optimum requirement and that there were several reasons why yellow turn signal DRLs were suitable for motorcycles.

Digitally enhanced mock-up of proposed turn signal DRLs

At the time I was unable obtain funding to take the concept further and no trials have been conducted in Australia. There have been several developments since that paper was prepared:

- The European Commission has decided to make white dedicated DRLs mandatory on new cars in Europe. Some of my earlier research contributed to that decision.
- Motorcycles are not covered by the EC initiative and there is concern that motorcycles without DRLs will be masked by cars with DRLs. This concern is largely unfounded but, in any case, is easily addressed by fitting effective DRLs to motorcycles
- Energy-efficient white LED DRLs have been introduced on Audi cars and Hella now markets an LED DRL retrofit kit. With the EC initiative we will soon see the widespread use of LED DRLs on cars.
- Aftermarket yellow turn signal DRLs can be purchased in the USA for fitting to motorcycles and some blogs refer to my research

There are several issues that researchers need to take into account when evalauting the effectiveness of DRLs on motorcycles.

Firstly, it is important that effective signal range be taken into consideration along with the perceived brightness of the tested lighting systems. I discuss this in a 1996 ESV paper on school bus lights (http://tinyurl.com/3blbce). For example, yellow lights appear to be brighter than white or red lights of the same luminous intensity but their signal range (distance at which they are reliably detected) is somewhat less than white or red lights. This is evident from Australian traffic signal standards, where yellow lights are required to have about three times the luminous intensity of red

traffic lights. The point from this is that it is not surprising that in field trials white lights usually perform better than yellow lights of the same luminous intensity. Such test would have been "fairer" if brighter yellow lights had been used.

The graph in my 2005 ESV paper (figure 1) shows the signal range for several types of automotive lights. The graph also plots sight distances for the design of road intersections at various traffic speeds in Australia. For example, an intersection with 60km/h traffic requires a minimum sight distance of 120m (Table 1). Yellow DRLs would need to be 900cd for this signal range on a bright day. White lights need to be at least 600cd. It turns out that many General Motors cars in the USA have 900cd yellow turn-signal DRLs and Paul Thompson from GM found these had the greatest reduction in collision rate (12.4%, compared with 3% for low-beam headlights - see Table 3 of the 2005 ESV paper and references to GM research).

I acknowledge that bright (900cd) yellow turn-signal DRLs on motorcycles would be novel in Europe and Australia and it would take a little time for motorists to understand their meaning. However, they would quickly come to understand that two yellow lights meant that a motorcycle was approaching and that distances needed to be judged differently to cars (because the motorcycle lights are closer together). I do not agree with some motorcycle lobby groups that, in general, car drivers with take greater risks if they know the approaching vehicle is a motorcycle - motorcyclists are much better off if the other motorist knows they are different and so distances and speeds require different judgement.

Another major advantage of turn-signal DRLs is that the direction of turn is unambiguous at a much larger range. With a single turn signal that, on a motorcycle, is necessarily close to the centreline of the vehicle the direction of turn may not be evident until the motorcycle is quite close. With my suggestion (as with GM cars) one light stays on and so the flashing of the other light instantly indicates the direction of turn. Added to this is the fact that most current motorcycle turn signals appear to be near the *minimum* regulated brightness and have poor signal range on bright days - replacing them with 900cd yellow lights would result in a vast improvement.

Finally, bearing in mind that motorcyclists and motorcycle manufacturers are loath to fit anything extra on the front of motorcycles, I thought that replacing current turn signals with brighter yellow DRLs would be more acceptable to these groups than adding white DRLs.

There exists a once in a lifetime opportunity to drastically improve motorcycle conspicuity through well-designed DRLs. *I recommend that the potential for bright yellow turn-signal DRLs on motorcycles be examined*.

Australia should also swiftly follow the European initiative and require dedicated bright white DRLs on new cars (simply change the current ADR from optional to mandatory). Arguments that Australian road conditions are brighter than Europe and that DRLs are only effective at high latitudes are based on misunderstandings about decades-old research. Dedicated bright LED DRLs would be highly effective on Australian roads and have the potential to reduce fatalities by about 10%.