DaDRL Comments on SWOV Daytime Running Lights Fact sheet

In this factsheet, the respected Netherlands research institute SWOV recommend to the European Commission the use of Daytime Running Lights (DRL) but the authors are negligent by:

- **not consulting expert ophthalmological opinion**
- **not conducting real DRL tests - slides in a laboratory were used**
- **doing studies of studies and which use flawed methodology and statistics**
- **proposing dedicated DRL without specifying a light intensity**
- **recommending alternative use of dipped headlights which can cause disability glare and change blindness in contravention of traffic laws**

If the European Commission were concerned with reducing road deaths and injuries for all road users why have they not mandated:

- **Advanced driving tests and regular re-tests?**
- **Eyesight tests at three year intervals (SWOV suggested eye tests in 2004)?**
- **headlights which do not cause glare and dazzle at any time**

Comments on the SWOV Factsheet are made in colour by DaDRL **July 2008**

SWOV Daytime Running Lights Fact sheet January 2008 www.swov.nl/rapport/Factsheets/FS_DRL.pdf

Summary

Following a number of European countries, Canada, and Israel, the Dutch Minister of Transport intends to make daytime running lights (DRL) compulsory also in the Netherlands. DRL increases the visibility of road users and thus reduces the chance of a crash. DRL's negative consequences, such as a higher fuel consumption and thus larger emissions of harmful materials, can be limited by using special DRL units with energy-saving lamps. Although several scenarios for implementing DRL are possible, the most favourable road safety option for the time being seems to be that in which drivers of existing motor vehicles use the manually dipped headlights in daytime and new cars are equipped with an advanced DRL unit.

Background

DRL involves motor vehicles having their headlights on during hours of daylight. These can be their dipped headlights or a special lighting unit. Having motor vehicle headlights on during the daytime makes motor vehicles more noticeable and saves road crash casualties.

DRL is already compulsory in a number of European countries. Until now this has not yet been the case in the Netherlands. However, it can be seen that many motorists voluntarily switch their headlights on during daylight hours, especially on rural roads and when the visibility is poor. The last time that the use of DRL was measured in the Netherlands was in 1993; 30% of the motorists then had their lights on (Lindeijer & Bijleveld, 1994). In January 2008, the Dutch Ministry of Transport has announced its intention to also make DRL compulsory in the Netherlands.

The EC aims at harmonizing the DRL regulations and the corresponding necessary vehicle requirements. It is important to emphasize the positive effects (saving road crash casualties) and to limit the negative effects (greater fuel consumption) as much as possible. Another point of interest for the EC is whether the road users who do not have their lights on (cyclists and pedestrians) will still be noticed, and whether motorcyclists (who already have their headlight on) are still sufficiently conspicuous. In 2003, the EC commissioned a study of DRL's effects and the implementation strategies, in preparation for a possible DRL implementation. Research institutes in the Netherlands (Netherlands Organization for Applied Scientific Research TNO and SWOV Institute for Road Safety Research) and in Norway (Institute of Transport Economics TØI) have carried out this study. This fact sheet not only deals with the results of this study, but also of studies carried out in the 1990s.

What is DRL's effect?

In-depth crash studies have shown that not having seen the other road user plays a role in 50% of the daytime crashes, and in even 80% of intersection crashes. Theoretical insight and observations explain DRL's effect mainly because of the greater contrast between vehicles and their surroundings; this increases the visibility of vehicles and makes them better identifiable. An additional effect is that vehicles with DRL are estimated to be closer than they really are. This explains why less risk is taken while overtaking and when crossing intersections.

DRL is a way to assist road users in their visual observation task. DRL studies in the 1990s indicated reductions of 10-15% (Elvik, 1996) and 8-22% (Koornstra, 1993) in the numbers of daytime crashes in which two or more road users were involved.

The study commissioned by the EC involved a meta-analysis of 41 studies of the effect for cars and 16

Note: meta-analysis = studies of studies which compounds errors and can be biased

studies of the effect for motorcycles (Elvik et al., 2003). This showed that for cars DRL reduced the number of daytime injury crashes by 3-12%, and for motorcycles by 5-10%. For both results we should mention that the results found per individual study (may) differ greatly. The reduction refers to daytime crashes in which more than one road user was involved. A greater effect on fatal crashes may be estimated. Some of the studies found that the DRL effect declined after some time, and others that it did not decline. No proof was found that the DRL effect depends on the season. The question of how strongly the effect depends on latitude indeed confirmed the previous study of Koornstra et al. (1997), but the relation is now shown to be less strong.

The matter of the extent to which rear lights that are on in the daytime can mask the brake lights, is no longer a problem since the introduction of the third brake light (compulsory in the Netherlands since 1994). In addition, automatic switches have the option of not automatically switching the rear lights on.

How visible are the other road users?

It is sometimes suggested that road users who do not have their lights on in daytime are visually 'pushed aside' by DRL vehicles, i.e. the masking effect. The EC also commissioned this to be studied. TNO carried out a laboratory experiment (Brouwer et al., 2004) in which subjects were shown slides with pictures of traffic situations in daylight circumstances. The slides contained a car with or without DRL and another road user: a pedestrian, a cyclist, or a motorcyclist with or without lights.

Are slides in a laboratory a valid substitute for the eye irritating and damaging blue glare emitted from real lights?

Why have the real – world Japanese 2003 studies recommending a low intensity 200cd been ignored?

The subjects were instructed to determine as quickly as possible if there was another road user present. The time needed to do this was registered.

The results were that subjects were able to identify the traffic situation of cars with DRL more accurately and quicker than that of cars without DRL.

No indications were found of a lesser conspicuousness of vulnerable road users when near a car with DRL. On the contrary, results pointed in the opposite direction: road users without lighting in fact profited from DRL.

The complete list of literature (inattentional blindness and all the related phenomena) can be cited Gestalt Psychology: Law of Prägnanz: discriminability, conspicuity, visibility of DRL-objects higher than all other traffic relevant objects - cui bono?

It is also an advantage that vulnerable road users can see cars with DRL sooner than cars without DRL.

This gives the vehicle driver an aggressive mental attitude of expecting people to jump out of the way whilst they barge through. Unfortunately all those victims could not jump out of the way in time.

The meta-analysis of Elvik et al. (2003) concludes - although with some reservation - that DRL probably reduces the number of car crashes involving cyclists and pedestrians.

Why are the UK European Pedestrians Associations opposed to DRL?

Why are the UK's CTC and European Cyclist Federation opposed to DRL?

As more DRL using Volvos are imported into the UK cyclist accidents continue to rise for the 3rd year - The Time 27 June 2008

A recent study carried out by the Austrian Epigus Institut (Pfleger, 2007) concludes that, based on study of road users' observation behaviour, DRL has no benefit in good weather, but is an advantage in bad weather. In rare cases DRL could be responsible for obscuring persons and vehicles
Motorcyclists in the Netherlands, who nearly all have their headlight on during daytime, sometimes express the fear that their conspicuousness lessens if cars also have their lights on during daytime. The TNO laboratory experiment (Brouwer et al., 2004) showed that the subjects saw both motorcycles with their lights off and motorcycles with their lights on sooner if cars also had DRL. However, motorcycles with DRL were spotted faster. Wildervanck (1994) already explained this phenomenon. By having his headlight on a motorcyclist separates himself from the static surroundings and thus is noticeable as a moving vehicle. And that is what it continues to be, even if the surrounding vehicles also have their lights on.

This seems to be a contradiction – motorcyclists say they will be lost in a sea of lights.

Why are the UK's BMF, MAG and European Motor Cyclist Federation FEMA opposed to DRL?

Recent statistical analysis indicates that the number of traffic accidents have been significantly reduced since the ban of DRL in Austria.

Does DRL have any disadvantages?

DRL has disadvantages. If the lamps are lit, the dynamo is switched on and more fuel is used. Although the extra consumption is the same per car, the relative differences are large. A fuel efficient car using 6.7 litres per 100 km (1:15) with DRL has an extra consumption of 3%, a 10 litres per 100 km (1:10) car uses 2% more, and a lorry of 33 litres per 100 km uses 1% more (ETSC, 2003). A larger fuel consumption causes a greater emission of harmful materials that produce air pollution. The CO2 emissions of car traffic increase by 0.6-1.4% (Elvik et al., 2003). Saving fuel and reducing CO2 emissions can be achieved by using special DRL lamps. Instead of 2x55W lamps for the dipped lights 2x21W can be used (a reduction of 62%). LED lamps of only a few Watts lead to an even higher reduction. In addition automatic switches can turn off unnecessary lighting (e.g. the rear lights).

Conspicuity of traffic relevant objects should be guaranteed from all angles of observation - Whenever the intensity of daylight is reduced to a level for switching on dipped headlights it is important to turn on the rear lights in addition. The DRL regulation - exclusively front lights, no rear light is simply wrong (the Austrian 'experiment') provoking rear end crashes side impact crashes (suggested also for bike illumination increased visibility from all sides (not only front and rear).

THERE IS NO INDICATION FOR DRL - AT NO TIME - AT NO GEOGRAPHICAL LATITUDE OR HIGHT - NOT EVEN MAXIMALLY REDUCED INTENSITY (Poeppel) - reduced sight (fog, low intensity of light during dusk or dawn etc) requires illumination of road surface and ALL traffic relevant objects (even rocks, branches, lost cargo, pedestrians, bikers, animals, reflectors, signs, road holes) PLUS the dipped headlight-beam being reflected from parking cars, objects, road surface etc is able to warn upcoming traffic participants. DRLs are unable to elicit any of these 'reflector functions'.

LED lamps are low power laser devices which are a health and safety hazard ref:
EU policy Health and safety at work: Exposure to optical radiation P6_TA-PROV(2005)0329 A6-0249/2005

Another disadvantage of DRL is that headlamps burn out more often, because they are switched on longer. This problem is small if LED lamps are used. Batteries can also run down if one forgets to turn the lights off. This can be solved by mounting a bleeper or an automatic DRL switch (after turning off the engine the dipped lights go out). Both can be installed in existing cars (Schoon, 1991).

There is also the matter of whether blinding occurs. Blinding has been researched extensively (Koornstra et al., 1997; Hagenzieker, 1990). The degrees of blinding vary from a nuisance to complete blinding. DRL can cause daytime blinding (especially nuisance) when the light intensity of the dipped light is too high and the surrounding lighting is at a relatively low level (also at sunset). The too intense dipped lights are due to incorrect adjustment. In fact this is not a DRL problem; the blinding is more severe at night time.

The eye uses different receptors between day time (cones) and night time (rods).

Cones: daytime = color, acuity
Rods: nighttime = adaptation, movements, peripheral visual field

During the processing of cognition there is a limited capacity to evaluate ~ more than four illuminated moving stimuli (DRL) - no training effect can improve this critical situation, no level of increased alertness might influence the VSTM capacity.

Nowadays dipped lights are quite well adjusted because of the MOT and built-in systems that ensure an automatic adjustment of headlights.

This statement shows the closeted world academics live in. If all roads were billiard smooth, then it would be true but in reality roads have traffic humps, some have potholes dips and crests and vehicles get loaded at the rear and rise at the front when accelerating. This causes dipped headlights (particularly HID types) to cause momentary disabling glare because self levelling mechanisms cannot cope with rapid undulations,

Causing dazzle or discomfort is illegal under UK and EU road safety rules e.g.

UK Highway code Rule 94:

"You MUST NOT use any lights in a way which would dazzle or cause discomfort to other road users"

Worst case scenario:

Disability glare is hard to measure and to analyze - 'glare accidents' will become an increasing phenomena.

With the increasing average age of the population dazzle, glare, adaptation and prolonged retinal recovery (following light 'stress') are growing problems.

These observations will not be found in protocols, no expert is dealing with this subject, no insurance company or risk researcher is interested in this topic, however the glaring DRL used by Audi, Volvo etc are helping to provide material evidence about these dangers.

DRL are the result of a cynical attitude of industry to a so called safety gimmik, the DRL experiment can be equated to vivisection, child abuse and violence, all threatening the unprotected using flawed methodology to PROVE a measure with inborn error.

Blinding does not occur with lamps that have been specially developed for DRL purposes.

Have the SWOV not seen Audi's blinding LED based DRL or Volvo's dazzling HID DRL?

Why have the UNECE increased the DRL limit from 400cd to a dazzling 1,200cd? (Japan recommended 200cd) The Auto industry is announcing super-bright DRL to outdo other products thereby ruthlessly threatening 'weaker' traffic participants.

What are the options for implementing DRL?

The EC requested that various options for DRL introduction in the EU be listed (Commandeur et al., 2003). These are:

1. only a behavioural measure with manual operation of dipped lights;
2. same as 1, but with a compulsory automatic DRL switch for *new cars*;
3. same as 1, but with a compulsory advanced DRL unit for *new cars*;
4. a compulsory automatic DRL switch for all *new cars*; 'old' cars without this facility do not have to use DRL;
5. same as 4, but with a compulsory advanced DRL unit.

The SWOV is neglectful by not specifying a maximum intensity limit for advanced (or dedicated) DRL (the UNECE have set the limit at a dazzling 1,200cd when the Japanese Government recommended only 200cd after conduction real-world tests)

Do the DRL effects compensate for the costs?

The Norwegian TØI research institute conducted a cost-benefit study of the five above-mentioned options (Elvik et al., 2003). This compared the positive effects, expressed in casualty reduction, with the DRL costs (environmental damage, fuel consumption, etc.). The calculations showed that the benefits by far exceeded the costs for all options. The scores were:

- high: option 1with a benefit-cost ratio of 2.0;
- middle: options 2, 3, and 5 with a benefit-cost ratio of 1.7, 1.7, and 1.6 respectively;
- low: option 4with a benefit-cost ratio of 1.4.

The benefit-cost ratios were calculated for twelve European countries over a period of twelve years. This was not done for Denmark, Finland and Sweden because these countries already have compulsory DRL. As an example we present here the calculation of option 3 in absolute figures (cost level 2003). The reduction of deaths and injured expressed in money amounts to € 49 billion, and the environmental damage amounts to € 10 billion. This is a benefit of € 39 billion. The total costs of advanced DRL units, extra fuel consumption, and lamps wearing out amounts to € 23 billion. This results in a ratio of 1.7. Option 3 was calculated for specific DRL lamps that use less energy than dipped lights. If a calculation had been made for LED lamps, the benefit-cost ratio of option 3 would have come up best.

- **What are the assumptions for the DRL cost-benefit analysis and casualty reduction?**

Based on the results of the meta-study of crashes the following assumptions for the effectiveness of DRL have been made for the cost-benefit analyses. The effectiveness in reducing the number of daytime multiple crashes is:

- fatal crashes: a reduction of 15%;
- severe injury crashes: a reduction of 10%;
- slight injury crashes: a reduction of 5%;
- Property Damage Only crashes: a reduction of 0%.

The actual DRL use in the twelve countries was assumed to be 10%. If making DRL compulsory increases the use to 90%, the estimation is that it can save 2,400 deaths, 17,000 severely injured and 51,000 slightly injured annually. These numbers are based on the number of casualties in 2000.

We can make the same assumptions for the Netherlands, but the current DRL use must be estimated higher than 10%. Because there are no recent measurements the estimate will be set at 30%, based on previous measurements. Compulsory DRL in the Netherlands would then result in an annual reduction of approximately 35 deaths and 500 in-patients. These numbers are based on the number of casualties in 2006.

How advanced is DRL's implementation?

In a number of countries DRL has been introduced in stages, for example by first encouraging voluntary use or by gradually making it compulsory (e.g. only on rural roads). Such a gradual introduction can help remove opposition, as was shown by a SWOV study for the EC. The opposition to DRL diminished rapidly after introduction and the acceptance was generally high. This was irrespective of whether it was a vehicle or a behavioural measure.

At present, fourteen European countries already have some kind of compulsory DRL for cars. In Denmark, Estonia, Finland, Latvia, Norway, Slovenia, the Czech Republic, and Sweden it is compulsory all year round, and on all roads. In Lithuania, Poland and Slovakia it is compulsory on all roads during the winter months. In Hungary and Italy it is compulsory on rural roads all year round. In Portugal, DRL is compulsory all year round on roads for which this is indicated.

In Austria compulsory DRL has been abolished as of 1 January 2008.

1 In Austria, DRL was abolished as of 1 January 2008; it had been compulsory from 2006 (also see SWOV position *Daytime running lights is safer*)

A victory for common sense in Austria plus significantly better statistical results (in spite of a number of vehicles still using DRL at high daytime light intensities)

In Belgium and Spain dipped lights are compulsory for motorcycles during daytime hours. In Switzerland DRL is recommended. The non-European country Israel has chosen compulsory DRL during the winter months on rural roads.

In countries where it is compulsory the driver must switch on the dipped lights manually (a behavioural measure). Only Canada has chosen for a vehicle measure; cars must be equipped with an automatic DRL switch. Swedish car manufacturers have also adopted this system. This means that in the Scandinavian countries where DRL is compulsory always and everywhere, many cars are equipped with automatic DRL switches. Also the Volvos and Saabs which are imported in the Netherlands are equipped with these switches.

In 2003, a SWOV inventory in 25 European countries showed that five other countries have plans directed towards compulsion, varying from a behavioural measure during winter months to an extensive technical measure. This last one is a French idea of an advanced DRL unit with lamps that have a light intensity between that of dipped lights and parking lights, and with a light sensor that ensures that the dipped lights

(and other switched off lamps) are automatically switched on at sunset (Robert, 2000). The Dutch Ministry of Transport has expressed itself to be in favour of this system for the Netherlands. In 2003 France has already made a modest start by recommending manually operated DRL on rural roads (CNSR, 2003).
In Europe there is concern about the negative environmental effects of DRL. This argues in favour of advanced DRL units with energy saving lamps. LED lamps would even result in environmental benefits for countries that currently have a high DRL use.

In August 2006, The EC put out a questionnaire on which both organisations and individuals, within as well as outside the EU, could give their opinion about DRL. In December 2006, the following results were published (*Table 1*)

Respondent	In favour of DRL		System		
	Ja	Nee	In favour of option 31	In favour of option 52	Unknown/other
Ministries	83%	17%	60%	30%	10%
Companies, e.g. research	87%	13%	72%	7%	21%
Associations, clubs	52%	45%	62%	-	38%
Individual citizens	4%	95%	-	-	-
1) Option 3: Manually operated and advanced MVO-unit immediately compulsory for new cars. 2) Option 5: Only an advanced MVO-unit compulsory for new cars.					

Tabel 1. *Result of an EU consultation in 2006 about the desirability of introducing DRL and the type of system.*

A large majority among governments, companies and associations appears to be in favour of the introduction of DRL; private individuals are opposed to the idea. The European Commission is considering proposals for behavioural measures and for vehicle demands for DRL. At this moment it is still unclear when the European Commission will make a definite decision on this issue. As was mentioned earlier, the Dutch Ministry of Transport intends to introduce DRL as a behavioural measure while awaiting possible European demands for new vehicles.

Conclusion

DRL can make a contribution to further improvement of road safety.

There is no scientific evidence for the frequently mentioned negative effects for pedestrians, cyclists or motorcyclists.

In real life (rather than SWOV academic studies) why have DRL experiments in Austria, Poland and Bulgaria have resulted increased accidents to pedestrians and cyclists?

The introduction of DRL as a behavioural measure can best coincide with the installation of an advanced DRL unit in new cars. This will result in a combination of a large casualty reduction and relatively low emission, especially when LED lamps are used. In January 2008, the Dutch Ministry of Transport has indicated to be in favour of this option.

The European Commission is now considering proposals for behaviour rules and vehicle requirements. Vehicle requirements can only be introduced at the EU level. Once these proposals are ready, national governments and the European parliament will have to decide on their positions.

Publications and sources
(SWOV reports in Dutch have an English summary)

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Most of these studies have been shown to use flawed methodology – see www.dadrl.org.uk/DRLstudies.html

Why has the real life Japanese Government Study in 2003 been ignored? – this recommended low power non glaring DRL with an intensity limit of 200cd.

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