HB 181

2823

26-LS0630\A

Av Thompson
AKTrucking Assoc.

Don Coffey
ABATE
opposes legislation

HOUSE BILL NO. 181

IN THE LEGISLATURE OF THE STATE OF ALASKA

TWENTY-SIXTH LEGISLATURE - FIRST SESSION

BY REPRESENTATIVES KAWASAKI, Gruenberg

Introduced: 3/12/09
Referred: Transportation, Judiciary

Definition — Vehicle 28.90.990 sub sec A 29

A BILL

FOR AN ACT ENTITLED

"An Act relating to the use of headlights when operating a motor vehicle."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* **Section 1.** AS 28.35 is amended by adding a new section to read:

Sec. 28.35.195. Use of headlights required. A person may not operate a motor vehicle on a highway unless the headlight system required by law for that motor vehicle is illuminated. A person who violates this section is guilty of an infraction.

DOT Supports
Signs will be needed

Kyle wants to exempt when there is Authorized by or instructed by State official / federal official.

they definition already in statute but could exempt AMHS.

One headlights defined in statute. YES: (what about parking & fog lights)

2824

Representative Scott Jiu Wo Kawasaki

Alaska State Legislature District 9 Fairbanks

Sponsor Statement for HB 181
Let There Be Light On Alaska Roads Bill

House Bill 181 addresses a key goal of the Alaska Highway Safety Office's Strategic Highway Safety Plan. The plan recommends changing state law to require car and truck headlight use at all times. Research shows a decrease in traffic accidents where daytime running lights are used. The Alaska Highway Safety Office has determined enforcements of the headlight law could decrease head-on collisions by 7 percent to 15 percent.

The effectiveness of "headlights on" laws can be seen in Alaska on the Seward Highway. In the mid-1990s, signs were installed along the highway from Anchorage to Seward requiring motor vehicles to have headlights on at all times. The Department of Public Safety and the Department of Transportation acknowledge the effectiveness of the headlight usage with instructional signs in saving lives. According to the Department of Transportation, there was a marked decrease in the number of crashes along the Seward Highway.

Similar results have been seen in other countries located in Polar Regions like Alaska. In Sweden, which has similar climate conditions to Alaska, studies have found that the requirement to use headlights at all times reduced crash rates by 20 percent in urban areas and 17 percent in rural areas in winter months.

Currently, 39 out of 50 states, including Alaska, require use of headlights on motorcycles at all times while operating on roads. Experts report the headlights increase the conspicuousness of motorcycles, allowing other motorists to more easily see them.

House Bill 181 will increase the safety on Alaska's roadways by making all vehicles easier to see while traveling, especially during Alaska's long periods of dusk and dawn. Please join me in supporting House Bill 181 and help make Alaska a safer place to drive.

R16-XXX

Border and Legend: Black
Background: White, Fluorescent Yellow

DRAFT

Road Class	Dimensions (inches) A	B	C	D	E	F	G	H	R
Minimum	60	42	0.63	0.88	3.0	6C	4.0	1.56	2.25
Conventional	84	54	0.75	1.25	4.25	8C	4.75	2.38	3.0

HH.3 Headlights On at All Times – Tier One

Description: Around 15 people die in Alaska each year in head-on crashes. National data indicate headlights-on signing and enforcement could eliminate 7 to 15 percent of these crashes.

This plan recommends changing state law to require headlights on at all times. If this is not done, we can still post signs that will make headlights mandatory on particular sections of road. 13 AAC 04.010 gives the signs the authority of law.

Responsible Agency:

Lead Agency: Alaska Department of Transportation and Public Facilities, Alaska Highway Safety Office (AHSO)

Contact Name, Title: Cindy Cashen, Highway Safety Office Administrator

Phone: (907) 465-4374 E-mail: Cindy.Cashen@alaska.gov

Necessary Partners:

- Governor's Alaska Highway Safety Office.
- DOT&PF Headquarters and Regional Offices.
- Legislature.
- Media.
- AG's Office.
- State Troopers/Local Police.
- National Insurance Institute.
- NHTSA.

Data Analysis Needs or Available Resources:

Create a statewide map of head-on collisions, insurance report, photos, past country/state success stories.

Expected Effectiveness/Outcome:

Narrative: To eliminate fatal and major injury crashes – estimate number yet to be determined.

Average number of lives lost and major injuries sustained due to this problem over the past five years: Approximately 15 per year.

Estimated number of lives saved and major injuries prevented in one year following implementation: One.

Funding and Resource Requirements:

Narrative: Funding for AHSO to cover legal costs – approximately $10K. If signs are posted, approximately $1,000 per sign.

Estimated Cost to Implement: $ TBD

Action Steps and Timeline

Action Step	Responsible Agency	Timeline/Due Date
Collect data and success stories in a draft packet for the legislature.	AHSO	December 2007
Collaborate with partners to develop a legislative information/ lobby plan.	AHSO	December 2007
Pass Legislation.	Legislature	May 2008
If successful, install signs in high-crash areas. (This could happen earlier.)		

Measurement and Evaluation

Strategy Performance Measures: Reduction in head-on collisions.

Evaluation:

Reduction in head-on collisions as indicated by before/after crash studies.

Headlights On At All Times Law (SB73 - 2009)
Estimate of Sign Cost

Community/Area	Location	No of Signs
Prudhoe Bay	Departing South, Dalton Hwy	1
Fairbanks	Departing, Steese, Parks, Richardson	3
Delta	Departing, Richardson, Alaska Hwy N&S	3
Tok	Departing, Tok Cutoff W, Alaska Hwy N&S	3
Alaska Border-Alaska Hwy	For W-bound arrivals	1
Glenallen	Departing, Glen W, Richardson N&S	3
Wasilla	Departing, Parks Hwy N	1
Palmer	Departing, Glen Hwy E	1
Valdez	Departing Richardson Hwy N	1
Glen-Parks Interchange	Departing Glen E, Glen S, Parks N	3
Anchorage	Airport	2
	Departing South-Seward Hwy	1
	Departing North, Glen Hwy	1
Kenai	Airport	1
Seward	Departing, Seward Hwy N	1
Soldotna	Airport	1
	Departing, Sterling Hwy N&S	2
Homer	Departing, Sterling Hwy N	1
Haines	Departing Haines Hwy N	1
Alaska Border-Haines	For S-bound arrivals	1
Skagway	Departing Klondike Hwy N	1
Alaska Border-Klondike	For S-bound arrivals	1
Juneau	Ferry Terminal	1
	Airport, Yandukin& Shell Simmons	2
Ketchikan	Ferry Access to Airport-both sides on Tongass	2

39 Signs

Intent:

Install signs at:
Major Airports
Major Ferry Terminals
At Major Junctions
At border crossings

We want to minimize the number of signs- just post at major entry points or junctions of high volume roads

4 Line Sign

7	ft. wide
4.5	ft. tall
31.5	s.f.
110	$/s.f.
3465	Sign Cost
$ 135,135	Total

2828

LEGISLATIVE RESEARCH REPORT

FEBRUARY 27, 2009 REPORT NUMBER 09.154

STATE LAWS REQUIRING THE USE OF HEADLIGHTS

PREPARED FOR REPRESENTATIVE MAX GRUENBERG

BY ROGER WITHINGTON, LEGISLATIVE ANALYST

You asked about state laws requiring the use of automobile headlights while driving. Specifically, you asked what jurisdictions, if any, require the daytime use of headlights. For the jurisdictions that require daytime use of headlights, you also asked us to provide copies of the laws or regulations that require such use, as well as a sample of newspaper articles or research reports that evaluate the merits of daytime headlight use.

HEADLIGHT LAWS

According to the *2009 Digest of Motor Laws*, prepared by the American Automobile Association, all states have statutes or regulations specifying when drivers must use headlights. Sixteen states require drivers to use headlights when windshield wipers are operating (Alabama, Arkansas, California, Delaware, Illinois, Louisiana, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, and Virginia). Additionally, nineteen states require drivers to use headlights during periods of inclement weather such as snow or rain (Connecticut, Florida, Georgia, Iowa, Maine, Minnesota, Montana, New Hampshire, New Jersey, New York, North Dakota, Oklahoma, Pennsylvania, Rhode Island, Tennessee, Utah, Vermont, West Virginia, and Wyoming). Table 1 summarizes the laws requiring the use of headlights when operating passenger vehicles in all 50 states. As you can see from Table 1, no state requires the use of headlights at all times, regardless of the weather.

Table 1: State Requirements for Headlight Use When Operating Passenger Vehicles

State	Headlights Must be Used: Half Hour After Sunset and Half Hour Before Sunrise	Headlights Must be Used: From Sunset to Sunrise	Headlights Must be Used: When Windshield Wipers are Operating	Headlights Must be Used: During Inclement Weather	Maximum Sight Distance Before Headlight Use is Mandatory (in feet)
Alabama		Yes	Yes		500
Alaska	Yes				1,000
Arizona		Yes			500
Arkansas	Yes		Yes		500
California	Yes		Yes		1,000
Colorado		Yes			1,000
Connecticut	Yes			Yes	1,000
Delaware		Yes	Yes		1,000
Florida		Yes		Yes	1,000
Georgia	Yes			Yes	500
Hawaii	Yes				200
Idaho	Yes				500
Illinois		Yes	Yes		1,000
Indiana		Yes			500
Iowa		Yes		Yes	500
Kansas		Yes			1,000
Kentucky	Yes				350
Louisiana		Yes	Yes		500
Maine	Yes		Yes	Yes	1,000
Maryland	Yes		Yes		1,000
Massachusetts	Yes		Yes		200
Michigan	Yes				500
Minnesota		Yes		Yes	500
Mississippi		Yes			500
Missouri	Yes				500
Montana	Yes			Yes	500
Nebraska	Yes				500
Nevada	Yes				1,000
New Hampshire	Yes			Yes	1,000
New Jersey	Yes		Yes	Yes	500
New Mexico	Yes				500
New York	Yes		Yes	Yes	1,000
North Carolina		Yes	Yes		400
North Dakota		Yes		Yes	1,000
Ohio	Yes				1,000
Oklahoma	Yes			Yes	500
Oregon		Yes			1,000
Pennsylvania		Yes	Yes	Yes	1,000
Rhode Island		Yes	Yes	Yes	500
South Carolina	Yes		Yes		500
South Dakota	Yes				200
Tennessee		Yes		Yes	200
Texas	Yes				1,000
Utah	Yes			Yes	1,000
Vermont	Yes			Yes	150
Virginia		Yes	Yes		500
Washington	Yes				1,000
West Virginia		Yes		Yes	500
Wisconsin	Yes				500
Wyoming	Yes			Yes	1,000

Sources: *Digest of Motor Laws*, American Automobile Association, 2009, and the National Conference of State Legislatures, (303) 364-7700.

2830

Although your question specified the use of daytime headlight use, daytime running lights—or DRLs—are the devices that appear to be most frequently debated. As you may know, DRLs are automotive lighting device mounted on the front of a motor vehicle, that automatically switch on when the vehicle is either started or moves forward. The intent of DRLs is to increase the visibility of the vehicle.

According to the Insurance Institute for Highway Safety, DRLs are

> a low-cost method to reduce crashes. They are especially effective in preventing daytime head-on and front-corner collisions by increasing vehicle conspicuity and making it easier to detect approaching vehicles from farther away.[1]

The Insurance Institute for Highway Safety also notes that laws in Canada and many European countries require vehicles to operate with lights on during the daytime.[2] They further note that there are two types of laws: those that require vehicles to be equipped with DRLs (Canada and the United Kingdom), and those that require motorists to turn on their headlights if their vehicles do not have automatic DRLs (Europe).[3] We include the "Daytime Running Lamps" section of the Canada Motor Vehicle Safety Standard 108 as Attachment A.

You indicated in your request that you are particularly interested in a Yukon Territory law that requires full-time headlight use. In Attachment B, we include the headlight section of the Government of Yukon, Motor Vehicles Act, Chapter 153, Sections 177 through 179. Section 178(3) states that:

> No person shall operate a motor vehicle on a prescribed highway at anytime unless both headlamps are alight.

Section 178 further states that "headlamps" include daytime driving lights.

In 2003, the SWOV Institute for Road Safety Research published a report that provides an inventory of DRL laws in some European Union countries and North America.[4] The report also

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[1] According to its website, the Insurance Institute for Highway Safety is an independent, nonprofit, scientific, and educational organization dedicated to reducing the losses — deaths, injuries, and property damage — from crashes on the nation's highways. The URL for the Insurance Institute for Highway Safety is *http://www.iihs.org/default.html*.

[2] Daytime running lights are not currently required in the United States. They are, however, allowed; the Federal Motor Vehicle Safety Standard 108 (FMVSS 108) regulates all automotive lighting, signaling and reflective devices in the United States. The FMVSS 108 is administered by the United States Department of Transportation's National Highway Traffic Safety Administration. In 1995, shortly after the FMVSS 108 became effective, General Motors (GM) equipped most of its vehicles with DRLs. By 1997 GM equipped all of its vehicles with DRLs and still does so today. A number of other car manufacturers that sell automobiles in the U.S., such as Saab, Suzuki, Subaru, Volkswagen, and Volvo have gradually added DRLs to some of their models. Please keep in mind that DRLs can take several forms; DRLs can be a separate fixture on an automobile, an independent bulb within an automobile's headlight housing, or a device that turns on an automobile's low-beam headlight.

[3] Insurance Institute for Highway Safety reports that Finland first mandated daytime running lights in winter on rural roads in 1972, and ten years later made DRLs mandatory year-round. Laws in Sweden took effect in 1977, in Norway in 1986, in Iceland in 1988, and in Denmark in 1990. Laws passed in 1993 in Hungary require drivers on rural roads to operate with vehicle lights on. Laws in Canada require DRLs for vehicles made after December 1, 1989.

[4] According to its website, the SWOV Institute for Road Safety Research (*http://www.swov.nl/index_uk.htm*) is an independent, scientific institute that promotes road safety through scientific research.

details how the legislation was implemented in these countries as well as an assessment of what was learned from the implementation process. Although this report is somewhat dated, we include it as Attachment C as you may find it useful.

According to Anne Teigen, Transportation Policy Specialist, with the National Conference of State Legislatures (NCSL), a bill which would have required use of headlights while operating a motor vehicle at all times, was introduced in the Michigan Legislature in 2008. Senate Bill 1138 appears to have died without a hearing. Nevertheless, we include it as Attachment D.

As noted above, Alaska does not currently have a mandatory daytime headlight or DRL law. However, 13 AAC 04.010 (c) states that:

> Every vehicle traveling on a highway or vehicular way or area must illuminate lights when traveling on any roadway that is posted with signs requiring the use of headlights.

According to Captain Hans Brinke with the Alaska State Troopers, the Seward Highway is the only highway currently posted for daytime headlight use.[5]

DAYTIME HEADLIGHT OR RUNNING LIGHT RESEARCH

A number of research reports assess the effectiveness of daytime headlight or running light use. Generally, daytime headlight or running lights appear to reduce accident rates, although the evidence is still in dispute.

Daytime headlight or running lights help reduce the number of traffic accidents by allowing other road users to be seen earlier, even in bad weather or traffic conditions. Pedestrians and cyclists see approaching vehicles better, and the lights increase the contrasts between vehicles and background that may otherwise be difficult to discern, due to, for example, clouds, sun glare, or areas with dense vegetation.

Some of the concerns regarding daytime headlight or running lights pertain to the possible safety limitations, such as turn signal masking by adjacent high-intensity DRLs; a potential reduction in motorcycle safety since motorcycles are no longer the only vehicles displaying headlights during the day; and shortened bulb life and higher fuel consumption.

We include the following three documents that discuss the safety benefits of daytime headlight or running light use.

In September 2004, the U.S. Department of Transportation, National Highway Traffic Safety Administration issued a technical report entitled "An Assessment of the Crash-Reducing Effectiveness of Passenger Vehicle Daytime Running Lamps (DRLs)." This study estimates the effectiveness of passenger vehicle daytime running lights in reducing two-vehicle opposite direction crashes, pedestrian/bicycle crashes, and motorcycle crashes. The significant results of this study show that from 1995 to 2001:

[5] Captain Hans Brinke, Department of Public Safety, Alaska State Troopers can be contacted at 907-269-5682.

- DRLs reduced opposite direction daytime fatal crashes by 5 percent.

- DRLs reduced opposite direction/angle daytime non-fatal crashes by 5 percent.

- DRLs reduced non-motorists, pedestrians and cyclists, daytime fatalities in single-vehicle crashes by 12 percent.

- DRLs reduced daytime opposite direction fatal crashes of a passenger vehicle with a motorcycle by 23 percent.

We include this report as Attachment E.

In 2008 the SWOV Institute for Road Safety Research published a Fact Sheet that provides a summary of DRL issues. Included in the Fact Sheet are numerous cites to research reports that various countries have used when considering DRL laws. We include this Fact Sheet as Attachment F.

In 2006 *Business Week* summarized some of the major research reports on the effectiveness of DRLs. Nearly all of these reports indicate DRLs reduce multiple-vehicle daytime crashes. We include this article as Attachment G; samples of the reports noted by *Business Week* are as follows.

- A study examining the effect of Norway's DRL law from 1980 to 1990 found a 10 percent decline in daytime multiple-vehicle crashes. (R. Elvik, "The Effects on Accidents of Compulsory Use of Daytime Running Lights for Cars in Norway," *Accident Analysis and Prevention* 25:383-98, 1993)

- A Danish study reported a 7 percent reduction in DRL-relevant crashes in the first 15 months after DRL use was required and a 37 percent decline in left-turn crashes. (L.K. Hansen, "Daytime Running Lights in Denmark: Evaluation of the Safety Effect," Danish Council of Road Safety Research, 1993.)

- In a second study covering 2 years and 9 months of Denmark's law, there was a 6 percent reduction in daytime multiple-vehicle crashes and a 34 percent reduction in left-turn crashes. (L.K. Hansen, "Daytime Running Lights: Experience with Compulsory Use in Denmark," Proceedings of the Fersi Conference, Lille, Denmark, 1994.)

- A 1994 Transport Canada study comparing 1990 model year vehicles with DRLs to 1989 vehicles without them found that DRLs reduced relevant daytime multiple-vehicle crashes by 11 percent. (H. Arora, D. Collard, G. Robbins, E.R. Welbourne, and J.G. White; "Effectiveness of Daytime Running Lights in Canada," Report No. TP-12298, Transport Canada, 1994.)

I hope you find this information to be useful. Please do not hesitate to contact us if you have questions or need additional information.

LIST OF ATTACHMENTS

Attachment A

Motor Vehicle Safety Act, Motor Vehicle Safety Regulations (C.R.C., c. 1038), SCHEDULE IV (Sections 2, 5 and 6 and subsection 12(3)), Canada Department of Justice, *http://laws.justice.gc.ca/en/ShowDoc/cr/C.R.C.-c.1038/sc:4::sc:5//en?page=11&isPrinting=false*

Attachment B

Government of Yukon, Motor Vehicles Act, Chapter 153, Sections 177 through 179, *http://www.gov.yk.ca/legislation/pages/page_a.html*

Attachment C

Jacques Commandeur, *State of the Art with Respect to Implementation of Daytime Running Lights*, SWOV Institute for Road Safety Research, 2004, *http://www.swov.nl/index_uk.htm*

Attachment D

Senate Bill 1138, Michigan State Legislature, 2008, *http://www.legislature.mi.gov/(S(sapn303cev1ccufuvn2pjtip))/mileg.aspx?page=getObject&objectName=2008-SB-1138*

Attachment E

Joseph M. Tessmer, "An Assessment of the Crash-Reducing Effectiveness of Passenger Vehicle Daytime Running Lamps (DRLs)," U.S. Department of Transportation, National Highway Traffic Safety Administration, Mathematical Analysis Division, National Center for Statistics and Analysis, September 2004, *http://www-nrd.nhtsa.dot.gov/Pubs/809760.PDF*

Attachment F

SWOV Fact Sheet, "Daytime Running Lights (DRL)," SWOV Institute for Road Safety Research, 2004, *http://www.swov.nl/index_uk.htm*

Attachment G

"Q&A: Daytime Running Lights," *Business Week*, December 2005, *http://www.businessweek.com/autos/content/jan2006/bw20060103_179336.htm*

Motor Vehicle Safety Act

Motor Vehicle Safety Regulations (C.R.C., c. 1038),

SCHEDULE IV (Sections 2, 5 and 6 and subsection 12(3))

Canada Department of Justice

http://laws.justice.gc.ca/en/ShowDoc/cr/C.R.C.-c.1038/sc:4::sc:5//en?page=11&isPrinting=false

Daytime Running Lamps

General

(44) Every bus, multi-purpose passenger vehicle, passenger car, three-wheeled vehicle and truck shall be equipped with two daytime running lamps or, where the daytime running lamps are optically combined with the upper beams of the headlamps, with two or four daytime running lamps.

(45) A daytime running lamp shall be white, yellow or white to yellow, in accordance with sections 3.1.3, 3.1.2 and 3.1.3.1, respectively, of SAE Standard J578, Color Specification (May 1988).

(46) A daytime running lamp that is not optically combined with a headlamp shall conform to SAE Recommended Practice J575, Tests for Motor Vehicle Lighting Devices and Components (December 1988).

(47) Subject to subsection (47.1), a daytime running lamp that is not optically combined with another lamp or is optically combined with a lamp, other than a front fog lamp, that is not required by this section shall be designed to conform to SAE Recommended Practice J2087, Daytime Running Lamps for Use on Motor Vehicles (August 1991), including the photometric values set out in Table 2 of this Recommended Practice, except that

(a) the maximum luminous intensity at any test point shall be 3 000 cd;

(b) the lamp is not required to conform to section 6.2 of that Recommended Practice; and

(c) the effective projected luminous lens area of the lamp may be less than 40 cm2.

(47.1) A daytime running lamp that is not optically combined with another lamp may conform to SAE Standard J583, Front Fog Lamps (June 1993), or to sections 3, 4.2, 4.3, 5 and 6 of ECE Regulation No. 19, Uniform Provisions Concerning the Approval of Motor Vehicle Front Fog Lamps, Revision 3 (March 2, 1993).

(47.2) A daytime running lamp that is optically combined with a front turn signal lamp or a parking lamp shall conform to subsection (47).

(48) A daytime running lamp that is optically combined with a headlamp shall

(a) where combined with the lower beam of a headlamp that is designed to conform to the photometric requirements of this section, operate at normal operating voltage or

(i) in the case of a DC system, not less than 75 per cent and not more than 92 per cent of the normal operating voltage, and

(ii) in the case of an AC system or a modulated voltage system, the equivalent root mean square of not less than 75 per cent and not more than 92 per cent of the normal operating voltage;

(b) where combined with the lower beam of a headlamp that is designed to conform to the photometric requirements of section 108.1, operate at normal operating voltage or

(i) in the case of a DC system, not less than 86 per cent and not more than 92 per cent of the normal operating voltage, and

(ii) in the case of an AC system or a modulated voltage system, the equivalent root mean square of not less than 86 per cent and not more than 92 per cent of the normal operating voltage; and

(c) where combined with the upper beam of a headlamp, be designed to provide a luminous intensity of not less than 2 000 cd and not more than 7 000 cd at test point H-V.

(49) For the purpose of determining if a daytime running lamp conforms to subsection (48), the daytime running lamp shall be tested in accordance with section S11 of TSD 108.

(50) A daytime running lamp that is optically combined with a headlamp or headlamps in which two filaments operate together to provide the daytime running lamp function shall meet the photometric requirements of paragraph (48)(c) when

(a) the daytime running lamp is provided by

(i) an upper beam that is provided by two filaments in the headlamp,

(ii) an upper beam and a lower beam of the headlamp, or

(iii) an upper beam of the headlamp, and a lower beam or upper beam of another headlamp; and

(b) the luminous intensities at the test point H-V of each headlamp, tested in accordance with section S10 of TSD 108, are added together.

(51) Where a daytime running lamp is optically combined with a headlamp that is activated in its concealed position, the daytime running lamp shall conform to subsection (47), (48) or (50).

(52) A daytime running lamp may be optically combined with a front fog lamp that conforms to SAE Standard J583, Front Fog Lamps (June 1993) or to sections 3, 4.2, 4.3, 5 and 6 of ECE Regulation No. 19, Uniform Provisions Concerning the Approval of Motor Vehicle Front Fog Lamps, Revision 3 (2 March 1993).

(53) Despite subsections (45) to (52), a vehicle may be equipped with a daytime running light system that conforms to Canadian Standards Association Standard CAN/CSA-D603-88, Daytime Running Light Systems (April 1988), other than a Type 4 and Type 5 system (reduced voltage upper beam headlamps), as indicated in Table 1 of the Standard, if

(a) the daytime running light system components are installed in accordance with the instructions referred to in section 8.2 of the Standard; and

(b) where the vehicle is equipped with gaseous-discharge lower beam headlamps, only a Type 1 system (normal voltage lower beam headlamp) or a Type 6 or Type 7 system (separate lamps other than headlamps), as indicated in Table 1 of the Standard, is used.

Allison Laffen

From: Stancliff, Sue M (DPS) [sue.stancliff@alaska.gov]
Sent: Monday, March 23, 2009 10:14 AM
To: Allison Laffen
Cc: Mercedes Theuer
Subject: HB 181

Good morning Allison,

We have conducted research into this matter and the short answer is no, the vehicle would not be dead-lined / placed out of service for having one headlight out. This applies to both commercial and non commercial vehicles, driving during the day, at night, or times of limited visibility. Drivers of vehicles with one light out are currently subject to being stopped and cited, but it is common practice to let them continue on their way. DOT and DPS would not change their practice based upon these bills. Further, per DOT, federal law (49 CFR) allows for a CMV to stay in service with at least one operating headlight, tail light, and brake light.

Hope that answers your questions.

Sue

From: Stancliff, Sue M (DPS)
Sent: Monday, March 16, 2009 11:00 AM
To: Dial, Rodney L (DPS)
Subject: FW: HB 181

Rodney ~ could you please review this and provide me with a response?

Thank you.

Sue

From: Allison Laffen [mailto:Allison_Laffen@legis.state.ak.us]
Sent: Sat 3/14/2009 6:35 PM
To: Stancliff, Sue M (DPS)
Subject: HB 181

Ms. Stancliff:

I hope you are the right person to direct my question to, I saw you are the legislative liaison for Public Safety. I have had a question from the AK Trucking Association (AKA) on HB 181, which Rep. Gruenberg is a cosponsor of, and the Senate version SB 73. HB 181 amends AS 28.35 by requiring the use of headlights at all times while driving, and a violation is an infraction. Here is the question they sent to me:

"Would either of these bills cause a vehicle with a burned out or broken headlamp to be placed out of service, that is, stopped until the headlamp is replaced? Broken and burned out headlamps as well as other lamps burn out or are broken particularly on gravel roads like the Dalton Highway. A spare headlamp or other lamps are not normally in the tool kit. Currently in our experience, the enforcement posture is to issue a violation and allow the vehicle to continue to their destination for repairs."

Would you be able to tell whether HB 181 would change this standard practice of allowing vehicles to continue to their destination for repairs? Since it is an infraction, can the vehicle be taken out of service, even if that isn't standard practice?

Thank you for your time.

Allison Laffen
Legislative Aide
Rep. Max Gruenberg - D20
(907) 465-2840

Allison Laffen

From: Allison Laffen
Sent: Monday, March 23, 2009 9:54 AM
To: 'Stancliff, Sue M (DPS)'
Cc: Mercedes Theuer; Tabitha Williams
Subject: RE: HB 181

Sue -

I've cc'd Rep. Kawasaki's staff on this email as well as he is the prime sponsor and carrying the bill. It is scheduled to be heard in House Transportation tomorrow at 1:00pm if you have a chance to get an answer to this question before then.

Thanks Sue.

Allison Laffen
Legislative Aide
Rep. Max Gruenberg - D20
(907) 465-2840

From: Stancliff, Sue M (DPS) [mailto:sue.stancliff@alaska.gov]
Sent: Sunday, March 15, 2009 6:14 PM
To: Allison Laffen
Subject: RE: HB 181

Allison - I'll get a response for you shortly, I think HB 181 is scheduled for a hearing this week. I have been in Anchorage for the past few days but on my way back to Juneau tonight.

Sue

From: Allison Laffen [mailto:Allison_Laffen@legis.state.ak.us]
Sent: Sat 3/14/2009 6:35 PM
To: Stancliff, Sue M (DPS)
Subject: HB 181

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Allison Laffen
Legislative Aide
Rep. Max Gruenberg - D20
(907) 465-2840

Alaska Trucking Association, Inc.
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The authoritative voice of the trucking industry in Alaska

HB 181
House Transportation Committee Hearing
1:00 pm, March 24, 2009
Aves D. Thompson, Executive Director
Alaska Trucking Association

Thank you. ~~Mr.~~ MADAM Chair[redacted] and members of the committee, I am Aves Thompson, Executive Director of the Alaska Trucking Association. The Alaska Trucking Association is a state wide organization representing the interests of our nearly 200 member companies from Barrow to Ketchikan. Each day, our industry delivers the essential items that all of us use in our daily lives. The simple truth is that "if you got it, a truck brought it."

Part of our mission statement provides that we promote highway and driver safety. We do this in a number of different ways. Our member companies conduct driver-safety meetings where safety regulations and other important safety matters are discussed. Many companies have full time safety professionals on staff to ensure safe operations. Company supervisors and managers are trained in safety of operations. As you can see, safety is a major concern in our industry.

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The bill at hand will cause headlamps to be illuminated at all times while driving a vehicle, whether a personal or a commercial vehicle. I believe that studies have shown there to be a positive impact on safety when headlamps are on. We are supportive of actions that can reduce crashes on our highways and as such are supportive of HB181 that will require headlamps to be illuminated while driving.

I will try to answer any questions. Thank you.

AARP

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March 23, 2009

The Honorable Bob Lynn, Chair
House State Affairs Committee
Alaska State Capitol, Room 104
Juneau, AK 99801-1182

RE: HB 123 (Fairclough)--Support

Dear Chair Lynn:

On behalf of the members of AARP in Alaska, we encourage you and your colleagues on the House State Affairs Committee to support HB 123, authored by Representative Anna Fairclough and co-sponsored by you and your Committee colleague Representative Peggy Wilson as well as Representative Beth Kerttula.

Unfortunately, Alaska has a high rate of suicide. Many of these suicides include mid-life and older Alaskans. The Statewide Suicide Prevention Council needs to continue its work and address this issue for our citizens. The Council still has much to do and, in our opinion, should be allowed to continue for another four years.

AARP requests an "AYE" vote on HB 123.

Should you have any questions about our position, please feel free to contact me (586-3637) or Patrick Luby, AARP Advocacy Director (907-762-3314).

Thank you for your consideration.

Sincerely,

Marie Darlin

Marie Darlin, Coordinator
AARP Capital City Task Force
415 Willoughby Avenue, Apt. 506
Juneau, AK 99801
586-3637 (voice)
463-3580 (fax)

CC: Vice-Chair Paul Seaton
Representative Carl Gatto
Representative Craig Johnson
Representative Peggy Wilson
Representative Anna Fairclough

HB 131 - Literatur

SWOV
INSTITUTE FOR
ROAD SAFETY RESEARCH

State of the art with respect to implementation of daytime running lights

Study in the framework of a European Commission project, Work Package 1

R-2003-28
Jacques Commandeur
Leidschendam, 2004
SWOV Institute for Road Safety Research, The Netherlands

Report documentation

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Summary

This report is part of the documentation of a project funded by the European Commission, designed to assess the effects of Daytime Running Lights (DRL) and possible strategies for implementing the use of DRL in the European Union (EU).
The objectives of the present report are two-fold:

1. to provide an inventory of the currently legislated requirements for the use of DRL in the EU and elsewhere, and how that legislation has been implemented in these countries.
2. to assess what has been learned from the existing implementations, so as to take these findings into account in the later development of realistic implementation strategies.

To this end, the relevant questions and issues to be addressed were identified and formulated, and a questionnaire was written and sent to the following countries:

- all fifteen member states of the EU;
- the future EU countries where DRL has been implemented;
- the remaining countries where DRL has been implemented and where the safety effects of DRL have in some form been evaluated.

The inventory of the currently legislated requirements for the use of DRL in the EU and elsewhere shows that DRL has been implemented both as a technical and as a behavioural measure. So far, the majority of DRL countries chose to impose DRL as a behavioural measure. However, most cars in the Scandinavian countries (Denmark, Finland, Norway and Sweden) are sold with an automatic DRL switch as well. The countries which currently have legislation on the use of DRL can be further distinguished in whether they impose DRL during the entire year or in winter time only, and on all roads or on rural roads only.

When setting up European guidelines for the implementation of DRL, it is important to take the arguments against DRL into account. These arguments are enumerated in the present report. Since most of the adverse effects mentioned in these arguments can be minimised or even completely solved by the implementation of DRL as a technical measure, it is recommended to make the installation of automatic dedicated DRL on new cars –combined with a light sensitive switch automatically activating the low beam headlights in reduced visibility conditions (and deactivating the DRL)- at least part of the DRL implementation scenarios to be developed later in the project.

In DRL countries the use of media campaigns during the introduction of DRL was found to range all the way from no media campaigns at all in Hungary to massive media campaigns in Canada. Since all DRL countries indicate not having met with much resistance and opposition against DRL after its implementation, there does not seem to be much that can be learned in terms of what type of media campaign would be optimal when introducing DRL in a non-DRL country. However, the Canadian expert on DRL recommends that other countries intending to implement DRL policies take steps to inform their population about the basic workings of visual perception relative to the driving task, since some of the comments from the Canadian

public about DRL seemed to reflect a lack of understanding of the role and importance of contrast in aiding visual perception.

Most DRL countries used a gradual approach to the implementation of DRL, either by encouraging the voluntary use of DRL before the introduction of DRL legislation, or by a gradual extension of compulsory DRL usage over more and more types of roads, over more and more months of the year, and/or for more and more types of road users.
Such gradual implementation strategies allow road users to gain personal experience in the visual workings of DRL, thus probably also contributing to obtain broader public acceptance for DRL legislation.

These findings, combined with the experience that most of the opposition against DRL greatly subsided in countries after DRL legislation was implemented, leads us to recommend that the implementation of DRL in non-DRL countries is preceded with a period of recommended DRL usage, accompanied with media campaigns clearly explaining how the visual workings of DRL contribute to the improvement of road safety.

Contents

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We would like to thank the following people:

John Berry, contact for this project at the European Commission, and René Bastiaans of the European Commission for their help in identifying knowledgeable individuals that could be contacted in a number of countries;

Professor Kåre Rumar of the Swedish Road and Transport Research Institute at Linköping, Sweden, Dipl.-Ing. Dieter Matthes, Chairman of the Groupe de Travail "Bruxelles 1952" (GTB), and Senior research psychologist Oliver Carsten of the University of Leeds, Great Britain, for their helpful comments on an earlier version of the present report;

Chris Schoon and Dr. Marjan Hagenzieker of the SWOV Institute for Road Safety Research, also for their helpful comments on an earlier version of this report;

Patrick Langeveld of the SWOV Institute for Road Safety Research for his help in designing the DRL questionnaires and in the extensive email activities involved in identifying knowledgeable individuals and institutions, and in obtaining as large a response to our inquiries as possible;

Last but not least, all the people mentioned in *Appendix 3* of the present report who were found willing to respond to all of our questions.

1. Introduction

This interim report is part of the project for the European Commission on Daytime Running Lights (DRL) with Contract No. ETU/B27020B-E3-2002-DRL-S07.18830. The objectives of the present report are two-fold:

1. to provide an inventory of the currently legislated requirements for the use of DRL in the EU and elsewhere, and how that legislation has been implemented in these countries.
2. to assess what has been learned, in these respects, under the existing implementations, so as to take these findings into account in the later development of realistic implementation strategies.

To this end, the relevant questions and issues to be addressed were identified and formulated, and a questionnaire was written and sent to the following countries:

- all fifteen member states of the EU;
- those future EU countries where DRL has been implemented;
- those remaining countries where DRL has been implemented and where the safety effects of DRL have in some form been evaluated.

Since not all of these countries have implemented DRL, two questionnaires were written: one specifically for "DRL countries" and the other specifically for "non-DRL countries". These two questionnaires can be found in *Appendix 1* and *2*, respectively, of the present report.

Before sending them the questionnaire, first a preliminary email was sent to knowledgeable individuals and institutes in the different countries announcing the objectives of the present work package, and requesting for the name(s) of national experts on DRL to which the relevant questionnaire could be sent for completion. A complete list of the countries that were finally contacted is shown in *Table 2.1*, including the (non-)response.

Table 2.1 shows that of the EU countries that currently have DRL legislation (i.e., Denmark, Finland, Italy, and Sweden), all returned the completed questionnaire. Of the EU countries that currently have no laws concerning DRL (i.e., Austria, Belgium, France, Germany, Greece, Ireland, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom), all countries returned the completed questionnaire except for Greece, Ireland, and Portugal (although they did receive the questionnaire). In Luxembourg, we were not able to locate any knowledgeable person to send the questionnaire to.

A list of the people contacted as well as the organisations or institutes they are affiliated with is given in *Appendix 3*.

The work includes an inventarisation of the original arguments pro and con in the current DRL-countries as well as the views on these arguments after implementation. This report does not discuss the strictly statistical aspects of DRL in terms of accident savings, etc. This is the subject of a separate report.

The questionnaires were also used to identify additional national experts on DRL in the different countries.

Country	DRL compulsory for all motorized vehicles?	Questionnaire sent?	To:	Filled-in questionnaire returned?
EU members				
Denmark	Yes	Yes	Lars Klit	Yes
Finland	Yes	Yes	Veli-Pekka Kallberg	Yes
Italy	Yes	Yes	Francesca la Torra	Yes
Austria	No	Yes	Klaus Machata	Yes
Belgium	No	Yes	Karel Hofman	Yes
France	No	Yes	Sylvain Lassarre	Yes
Germany	No	Yes	Ursula Einsfelder	Yes
Netherlands	No	Yes	Rob Wegman	Yes
Spain	No	Yes	Monica Colás	Yes
Sweden	Yes	Yes	Kåre Rumar	Yes
United Kingdom	No	Yes	Jeremy Broughton	Yes
Non-EU members				
Canada	Yes	Yes	Jim White	Yes
Czech Republic	Yes	Yes	Jaroslav Heinrich	Yes
Hungary	Yes	Yes	Peter Holló	Yes
Israel	Yes	Yes	Victoria Gitelman	Yes
Norway	Yes	Yes	Richard Muskaug	Yes
Switzerland	No	Yes	Ulrich Salvisberg	Yes
USA	No	Yes	Richard Vaniderstine	No, but sent three reports
Non-response				
EU members				
Greece	No	Yes	abek@certh.gr	No
Ireland	No	Yes	des_coppins@environ.irlgov.ie hilary_dalton@environ.irlgov.ie	No
Luxembourg	No	No	--	--
Portugal	No	Yes	almacedo@lnec.pt	No
Non-EU members				
Poland	Yes	Yes	Krzystof Jamrozik	No
Lithuania	Yes	Yes	vidmantas.pumputis@lra.lt	No

Table 1.1. *Overview of the countries contacted and their (non-) response.*

2. Results

2.1. DRL countries

In *Section 2.1* the answers to the DRL questionnaire are discussed for those countries where the use of DRL is compulsory for all motorized vehicles by law. Of the nine countries which responded to the questionnaire, four are currently members of the EU (Denmark, Finland, Italy, and Sweden), two are future members of the EU (Czech Republic and Hungary), and three are not a member of the EU (Israel, Norway, and Canada). These so-called DRL-countries are discussed in alphabetical order, starting with the four EU members. For all these countries, the answers to the questionnaire can be found in *Appendix 4*; the answers in *Appendix 4* are presented in tables, where the first column of each table contains shortened versions of the questions in the questionnaire. For the complete questions we refer to *Appendix 1*. A summary of the respondents' answers is presented below.

2.1.1. *Denmark*

The answers to the DRL questionnaire for Denmark are summarized in *Appendix 4.1*.
In Denmark the use of DRL has been compulsory for all motorized vehicles on all roads since October 1990. There are no requirements on how to switch on DRL. However, most cars are sold with an automatic on switch. The implementation of DRL was accompanied with spots on national television and information in the main newspapers, as well as with police enforcement campaigns during the first year of the introduction. The penalty for not using DRL is about € 65, but the usage seems to be very high and currently there are no police enforcement activities specially aimed at DRL. According to the respondent from Denmark, even though the Danish Cyclists Federation at some point opposed the introduction of DRL, and there was some debate in the media concerning the extra costs for car owners (increased fuel usage and more frequently burned-out lamp bulbs), the law was introduced nevertheless, and now seems to be accepted by most road users and organizations.

2.1.2. *Finland*

The answers to the DRL questionnaire for Finland are summarized in *Appendix 4.2*.
Compared to Denmark, Finland clearly used a more gradual approach in the implementation of compulsory DRL for all motor vehicles. At first it was only required during the five winter months in 1972. Then this was extended to a period of seven months in 1973. Next this was again extended to the entire year outside built-up areas in 1982, and finally to all roads during the entire year in 1997. In most vehicles DRL are automatically switched on when the engine is started. However, manually operated DRL are also allowed. According to the respondent from Finland, DRL were generally well accepted in Finland and there was no serious opposition, neither before nor after their gradual implementation. Only some individuals raised questions about the added costs due to higher fuel consumption with DRL.

2.1.3. *Italy*

The answers to the DRL questionnaire for Italy are summarized in *Appendix 4.3.*
Of all the countries discussed in the present report, the implementation of compulsory DRL in Italy in June 2002is the most recent: . Since that date, DRL have become mandatory during the entire year for all vehicles on motorways (urban and rural) and primary rural highways, and for motorcycles and scooters on all roads (urban and rural). Since DRL for four-wheeled vehicles are not required on all roads in Italy, they are switched on manually.
The implementation of DRL was introduced with media campaigns in all the newspapers, on television and on radio. In addition, for approximately one month after the introduction, the police gave no tickets but only warnings to drivers not using DRL when required. Nowadays tollway companies use messages and boards at the entrance of tollways reminding drivers to switch on their lights during daytime.
At this moment drivers not using DRL when required can be fined, € 32 according to the Expert from Germany (GRE, 2003), but from June 2003 onwards this will be replaced with a new "driving points" system. Out of the initial amount of 20 points, two points will be deduced if drivers do not use DRL when required, and four points if also their licence is less than 5 years old.
According to the respondent from Italy, apart from some individual complaints, there was no opposition against DRL in Italy, neither before nor after its implementation. Interestingly, before the introduction of DRL in Italy, car drivers could even be *fined* for switching on their lights during the day.

2.1.4. *Sweden*

The answers to the DRL questionnaire for Sweden are summarized in *Appendix 4.4.*
In Sweden the use of DRL has been compulsory for all motorized vehicles on all roads during the entire year since 1977. Although there are no legal requirements on how to switch on DRL, most modern cars are sold with an automatic 'on' switch.
All the media were used to inform the public during the introduction of DRL. Since the army, the railways, and some companies already were using DRL before 1977, by 1977 the public was already used to DRL and media campaigns were therefore not as strong as when this had not been the case. The penalty for not using DRL is about € 45. Initially there were some police enforcement activities aimed at the use of DRL, as well as at drivers forgetting to switch from reduced low beams to plain low beams in darkness. Currently enforcement is no longer necessary in Sweden due to the automatic switching on of DRL.
Both before and after the implementation, some groups are of the opinion that anybody who cannot see a motor vehicle in full daylight should not have a driver license, and other groups are of the opinion that the environmental damage and extra petrol consumption of DRL is a larger disadvantage than the reduced number of crashes. Motorcyclists often oppose general DRL because they would like to be the only category of road users having DRL. Right after the implementation of the mandatory use of DRL, the automatic switching on of DRL was unusual, and many individuals complained about dead batteries because they had forgotten to turn off the lights when

parking. However, with time, the opposition towards DRL has diminished substantially. One obvious reason is the improved technology (primarily automatic switching). Currently, DRL is not a political issue and all parties seem to agree on the present legislation. The main opposition is focused on the negative environmental effects of DRL, and many motorcyclists are still negative, for the reason mentioned above.

2.1.5. *Canada*

The extensive answers to the DRL questionnaire for Canada are given in *Appendix 4.5.*
In Canada, DRL were implemented by making automatic DRL systems compulsory on all new four-wheeled vehicles from December 1989 onwards. Automatic operation of the headlamp and rear position (tail) lamp of new motorcycles sold in Canada had already been made compulsory in 1975. Since DRL are switched on automatically, they are used on all roads and during the entire year.
The federal government decided to pursue the development of a new vehicle regulation as the least costly and most reliable long-term solution. According to the respondent of the questionnaire, it was obvious that all vehicles on the road should have DRL or switched-on headlamps to maximize the safety benefits and minimize the "masking" of unlit vehicles by lit ones. Therefore the provinces and territories, assisted by the federal government, undertook publicity campaigns stressing the safety merits of daytime lights use.
These DRL measures were introduced by the Canadian federal government which only regulates vehicle safety through laws applying to vehicle manufacturers and importers. Except for the Yukon Territory, however, provincial and territorial governments (which are responsible for regulations concerning road users and road use) have not yet introduced laws requiring lights to be switched on in daytime, except during inclement weather. Therefore, the *use* of DRL is not compulsory in Canada, except for the Yukon Territory where road users can be fined about € 60 when not using DRL on rural roads. Outside the Yukon Territory, there are no penalties for not using DRL, and there are no special police enforcement activities. Even so, because they are switched on automatically in practice, DRL are used by all motorized vehicles on all roads during the entire year. DRL must switch off automatically when headlights are switched on (e.g, at night).
From about 1987 to 1995 (that is, even before the implementation of automatic DRL systems on all new vehicles in 1989), Transport Canada and the provincial/territorial transportation authorities cooperatively produced and distributed a common design pamphlet and poster. The message, directed to drivers of pre-DRL vehicles, was to drive with low beam headlamps switched on at all times or to have a DRL switching kit installed for convenience. Transport Canada staff gave numerous press interviews and responses to direct requests for information from the public and other interested parties. The public (provincial) vehicle insurance corporations advertised in the media, primarily newspapers. Also, vehicle manufacturers mentioned DRL in their advertisements, particularly for models with DRL installed voluntarily before it became mandatory. Insurers also supported DRL with publicity of various kinds. Of particular note was Saskatchewan Government Insurance's "Lights on for Life" campaign. This initiative included a) newspaper and television advertising, b) message signs on highways, c) publicity materials such as brochures, stickers, key fobs, and d) information delivered by post, for example with licence renewal notices.

Transport Canada measured the daytime lights usage in several annual traffic surveys beginning in 1981, when 10.3 percent of vehicles were operated with lights on in daytime. Publicity campaigns raised the voluntary lights usage in daytime, in the four years (1986-89) before introduction of DRL on new vehicles, to between 17.5 and 21.7 percent.

Thus, before the implementation in 1989 all the publicity undoubtedly helped to ensure broad acceptance for the DRL regulation. Consequently, the public generally perceived DRL as sensible, although there were some concerns about glare.

After the implementation, DRL did not become a political issue. None of the political parties at the federal or provincial/territorial levels opposed it. There was not a lot of reaction from lobby groups, although some (but not all) vehicle manufacturers initially opposed the proposed regulation. The Canadian Automobile Association supported DRL. The Canadian Motorcycle Association initially opposed DRL on the basis that motorcycles would become relatively less conspicuous, even though motorcycles had been equipped with automatic headlamp systems since 1975 and thus were on an equal basis to DRL vehicles. However, there was little opposition from individual motorcyclists, perhaps because they recognized the benefit to themselves of seeing other vehicles better.

Some of the comments from the Canadian public about DRL seemed to reflect a lack of understanding of the role and importance of contrast in aiding visual perception. Some people thought that clear vision (usually expressed as an ability to see distant objects) somehow gave them a faultless ability to discern moving vehicles in visually complex surroundings including multiple targets. The Canadian respondent of the questionnaire therefore recommends that other countries intending to implement DRL policies take steps to inform their population about the basic workings of visual perception relative to the driving task.

As concerns acceptance after the implementation in 1989, DRL is not an issue any more. It is well accepted by all except a few who object to glare or see DRL as unnecessary government intervention in the driving process. The Road Safety and Motor Vehicle Regulation Directorate of Transport Canada receives few, if any, complaints about bulbs burning out, engine starting problems, etc.

There have been some complaints that rear position lamps (tail lamps) should be automatically activated with the DRL. The Canadian Motor Vehicle Safety Standard 108 allows tail lamps to be either on or off with DRL – in fact, vehicles with both arrangements are on the market. The occasional vehicle can be noticed at night being driven without tail lamps. Usually the driver notices, after a short distance, that the instrument panel is dark or that the DRL do not illuminate the road well, and so switches on the headlamps and position lamps.

2.1.6. *Czech Republic*

Appendix 4.6 summarizes the answers to the DRL questionnaire for the Czech Republic.

In the Czech Republic, the mandatory use of DRL was implemented in 1982 for motorcycles on all roads during the entire year, and in January 2001 for all four-wheeled motorized vehicles on all roads, but during winter months only. There were no media campaigns at the time of introduction. Fines for not using DRL during the required period range from € 7 to € 70, and police

enforcement is mostly applied at the beginning of winter time when DRL become compulsory again.
Since they are mandatory during winter time only, DRL can be switched on and off at will by the driver.
The respondent does not mention any opposition against DRL in the Czech Republic, either before or after its implementation, and notes that compliance is very high (an estimated more than 95%).

2.1.7. *Hungary*

Appendix 4.7 contains the answers to the DRL questionnaire for Hungary. Just like Finland, Hungary also took a gradual approach to the implementation of compulsory DRL for all motor vehicles. First, in 1984 it was made mandatory for motorcycles only on all roads during the entire year. Then, in 1993 this was extended to passenger cars, buses, and goods vehicles during the entire year, but on rural main roads only. Next, in 1994 this was again extended to passenger cars, buses, goods vehicles, tractors, slow vehicles, and mopeds on all rural roads. Finally, in 1995 mopeds had to carry DRL on all roads, just like motorcycles. Since DRL for four-wheeled vehicles are only mandatory on rural roads, these lights can be switched on and off manually by the driver.
According to the respondent, only leaflets were used in order to raise public awareness of the introduction of DRL.
Unfortunately, nothing is mentioned in the answers about the acceptance levels of DRL before and after its implementation. However, the respondent refers to his paper (Holló, 1998), which states that:
"As the authorities anticipated that a gradual phasing-in would make acceptance of the measure easier, DRL-usage became compulsory [...] only on one part of the road network outside built-up areas; that is, on the main roads and semi-motorways, as of March 1993."
The paper also mentions that, in the period directly after the new law was introduced in 1993, nearly 75% of drivers switched on their dipped headlights, even in extremely good visibility conditions in daylight. Moreover, according to Holló (1998):
"Positive results and the better than expected DRL-usage rates motivated the legislators to extend the earlier only partial DRL-obligation outside built-up areas to all roads outside built-up areas after 1 June 1994. The decision was partly based on the experience that a proportion of drivers –at first only negligible, but later steadily increasing- were additionally using their dipped headlights on motorways and side roads outside built-up areas in daylight, in good visibility conditions, so the extension of the obligation was hardly opposed [...]."
This shows that the gradual approach to the implementation of DRL in Hungary was consciously applied by the legislators in order to facilitate the acceptance of the measure by road users.

2.1.8. *Israel*

Appendix 4.8 summarizes the answers to the DRL questionnaire for Israel. In Israel, DRL were introduced in 1996 and are mandatory during winter time only. For two-wheeled vehicles, taxi's, buses, and commercial vehicles they are required on all roads, while all other motorized vehicles have to use DRL on rural roads only. Therefore, the DRL are switched on manually.

The implementation of DRL was preceded by an experimental period accompanied by an evaluation study in the winter of 1989/90. When DRL were implemented, there was a 3-month media and road-side campaign promoting the use of DRL.
Every year, during the winter period, there are reminding announcements in the media. Not carrying DRL during winter time in Israel can result in fines ranging approximately between € 20 and € 50, or in penalty points. DRL enforcement is part of regular police enforcement.
The measure seems to be well accepted, and some road users even use DRL voluntarily in summer time. Moreover, no lobbies or government parties have opposed DRL over the last years.

2.1.9. *Norway*

Appendix.4.9 contains the answers to the DRL questionnaire for Norway. In Norway, DRL was made compulsory on new motorized vehicles from January 1985 onwards, and on all vehicles from April 1988 onwards. Up to 1994 they had to be switched on automatically when starting the engine, but since 1994 this rule has been relaxed, and they are now also allowed to be switched on manually. In Norway, the measure applies to all roads during the entire year. Not carrying DRL can result in a fine of approximately € 125. There are no special police enforcement activities aimed at carrying DRL. The introduction of mandatory DRL was accompanied with brochures as well as newspaper advertisements and stickers on buses. Before the implementation of DRL, vulnerable road users (pedestrians, cyclists, and motorcyclists) were afraid that they would not be seen when DRL was introduced. However, this opposition apparently has evaporated, since DRL is now well accepted in Norway, and it is not on the political agenda. Moreover, the use of DRL is now close to 100%. It is interesting to note, however, that about one third of the motorized vehicles already used DRL voluntarily even before the introduction of this measure.

2.2. Non-DRL countries

In *Section 2.2*, the responses to the DRL questionnaire are discussed for those countries where the use of DRL is not compulsory for all motorized vehicles. Countries which currently only have DRL legislation for mopeds and/or motorcycles (e.g., Austria and Belgium) are considered as belonging to this category in the present report. Of the nine non-DRL countries who responded to the questionnaire, seven are member of the EU (Austria, Belgium, France, Germany, the Netherlands, Spain, and the United Kingdom), and two are non-EU members (Switzerland and the United States). In the following sections, these nine non-DRL countries are treated in alphabetical order. For all these countries, the answers to the questionnaire can be found in *Appendix 5*; the answers in *Appendix 5* are again presented in tables, where the first column of each table contains shortened versions of the questions in the questionnaire. For the complete questions we refer to *Appendix 2*.

2.2.1. *Austria*

Appendix 5.1 contains the answers to the DRL questionnaire for Austria. In Austria, where DRL is already mandatory for all motorized two-wheelers on all roads during the entire year, several attempts have been made to

implement compulsory DRL for all four-wheeled motor vehicles outside urban areas during winter time, the latest attempt being in 2002. Since they will not be required on all roads, and only in winter time, there are no plans in Austria for introducing automatic DRL on all four-wheeled motor vehicles. As the current voluntary use of DRL is concerned, observations of 31.000 cars in 2001 showed that 25.8% was carrying DRL in good weather conditions, 51.9% in cloudy weather, and 72.8% in rainy weather. In a KfV survey of 1000 citizens in December 2002, it was found that 75% think that DRL is a good or very good safety measure.
KfV strongly supports DRL, whereas Auto Clubs (and many others) are opposed. This was the reason for the rejection of the draft law in 2002.

Enclosed with the answers to the questionnaire, the respondent from Austria also sent us the Austrian road safety programme 2002-2010 (see the References). According to this document, the Austrian government introduced an extensive road safety programme in January 2002 that establishes the following target: to halve the number of deaths by the year 2010. Also according to this document, DRL belongs to one in the list of 26 priority areas that should be addressed in order to achieve this target. The Austrian Road Safety Board will discuss the medium-term introduction of DRL in rural areas during winter time, as well as the long-term support of implementing EU regulation ECE R87 regarding DRL lamps with lower power consumption (ECE, 1993).

2.2.2. *Belgium*

The answers to the DRL questionnaire for Belgium are summarized in *Appendix 5.2.*
In Belgium, the use of DRL has been mandatory since 1984 for two-wheeled mopeds and motorcycles which should carry a dipped headlight and red rear light at all times on all roads. Not complying to this legislation can be punished with a heavy fine of € 50 to € 500 or a prison sentence of 8 days to 1 month.
Due to a misunderstanding, the questionnaire for "DRL countries" in *Appendix 1* was sent to the representative of Belgium. After receiving the answers of this questionnaire shown in *Appendix 5.2*, we also sent the questionnaire for non-DRL countries in order to obtain information on possible plans in Belgium for the introduction of DRL for all vehicles. The answers to the latter questionnaire were that there are no such plans in Belgium, that there is no information on the current voluntary use of DRL in Belgium, and that DRL for all vehicles will only be implemented in Belgium if this should be decided at a European Union level.

2.2.3. *France*

The answers to the DRL questionnaire for France are given in *Appendix 5.3.*
In France, the use of DRL for motorcycles has been mandatory since 1975, but there are no plans for the implementation of the compulsory use of DRL for four-wheeled motorized vehicles. Motorcycle associations are strongly against the implementation of DRL for four-wheeled motorized vehicles. The French ministry of environment is concerned about the 1% of increase in CO_2 in the atmosphere due to more fuel consumption. Even the French 'Direction pour la circulation et la sécurité routière' (Directory for traffic and road safety) is not sustaining this measure.

In the French Département Les Landes, an experiment was carried out from June 1999 until June 2000, encouraging road users to use DRL (Lassarre, 2002). To this end, a brochure was sent to every household in Les Landes, 100,000 brochures were left in public places often visited by road users, a total of 49 board signs were installed along roads, and the campaign was supported by the local newspapers, radio, and television. In the first quarter of 2000 the campaign resulted in an observed average 22% voluntary use of DRL on main roads, and in an observed average 14.5% voluntary use of DRL on secondary roads. Moreover, in a questionnaire sent to all households of Les Landes in December 1999, 46% of the road users stated often using DRL, while 12% stated they used them all the time.

In the filled-in questionnaire from France, reference is made to the extensive French evaluation report 'La question de l'allumage des feux de croisement de jour' (The issue of daytime running lights) by Robert (2000). Because they have implications for the definition of realitistic future implementation scenarios, we have translated the most important conclusions concerning acceptance levels and possible implementation scenarios in Robert's report (see *Appendix 5.3*).
In the context of the objectives of the present report, the main point in these conclusions is that, if DRL should be proven to be effective in improving road safety, Robert (2000) estimates that the best strategy for rallying the different French organisations in favour of implementation would be a technical measure where special daytime running lights with an intensity somewhere between dipped headlights and parking lights are switched on automatically when the motor is started. According to Robert, this system has three advantages:

1. Vulnerable road users are not hindered while still improving their perception of cars and trucks.
2. It allows for the differentiation of motorcycles which could continue to ride with dipped headlights (which could moreover be coloured lights).
3. It is easily combined with the installation of receptors which switch on the dipped headlights when the ambient light is reduced (and automatically switch off the dedicated daytime running lights).

2.2.4. *Germany*

Appendix 5.4 contains the answers to the DRL questionnaire for Germany. In Germany, there are no plans of implementing the compulsory use of DRL for all motorized vehicles.
Germany sent us an informal document prepared by the official experts from Germany (GRE, 2003) entitled 'Summary of the discussion concerning daytime running lights in Germany'. Here, we quote the summary of this document verbatim:

"It is difficult to assess the further development of the discussion on the potential benefits of switching on the light during daytime. At the moment it seems rather unlikely that a regulation at European level is adopted imposing the obligation to use dipped headlights during daytime. Anyhow, the Federal Government will reject such a variant. But Germany still considers it necessary to perform further research work with regard to special daytime running lamps with a luminosity ranging between parking lights and dipped headlights.

There is currently no evidence indicating whether a benefit for road safety can be expected from such a measure and, if so, the extent of the benefit to be assumed. The mandatory equipment of motor vehicles with such additional lamps will certainly mean higher costs for vehicle buyers, the amount of which can, however, currently not be estimated. The fuel consumption will rise, too, although it might be significantly lower than it would be if dipped headlights were used as daytime running lights.
If the research work to be performed now resulted in a sufficiently positive cost-benefit ratio, the German proposal submitted to the ECE in 1999 concerning the regulation of the technical requirements to be placed on a "light sensitive switch" would remain of present interest. The fact that motorists switch on dipped headlights too late in the case of an insufficient ambient light could be improved by the automatic activation of the light if the brightness drops to a certain level.
This would, presumably, account for the essential part of the positive effects of daytime running lights so that this type of light could be dispensable in the future. But even if it was possible to prove the positive effects of special daytime running lamps, the "light sensitive switch" will remain an appropriate option. Daytime running lamps which are automatically activated would presumably result in the fact that motorists switch on dipped headlights too late, knowing that they use daytime running lamps, thus proceeding only with these lamps of a low light intensity when dipped headlights would already be required."

In the context of the objectives of the present report, the main point of the arguments above is that, if and only if dedicated DRL are proven to be effective in improving road safety, Germany would be willing to consider a technical measure where special daytime running lamps with a luminosity ranging between parking lights and dipped headlights are combined with light sensitive receptors activating the dipped headlights as soon as the ambient day light falls below a certain predetermined level; this is the same option as discussed by France.
The only difference with France is that, should the dedicated DRL not be proven effective, Germany would still be interested in the separate installation of the light sensitive receptors for dipped headlights.

2.2.5. *The Netherlands*

Appendix 5.5 summarizes the answers to the DRL questionnaire for the Netherlands.
In the Netherlands, plans were discussed in the early 1990s to make DRL mandatory for all motorized vehicles on all roads during the entire year, where the DRL would be switched on automatically. At this moment, the voluntary use of DRL in the Netherlands is estimated to be quite high (about 50%). DRL are used more often outside than inside built-up areas, and also more often in reduced daytime visibility conditions.
Public acceptance of DRL seems high (especially with car drivers). There is strong opposition from organizations of pedestrians, cyclists, and motorcyclists, who are afraid they will become relatively less conspicuous when DRL are made obligatory for all motorized vehicles. There are also concerns about extra fuel consumption and CO_2 emission.
In the early 1990s the voluntary use of DRL in the Netherlands was extensively monitored for a number years on a monthly basis, differentiating between weather conditions, regions, road types, city sizes, and inside

versus outside built-up areas (see Lindeijer & Bijleveld, 1991, 1994). However, these monitoring activities were later stopped when it became clear that the mandatory use of DRL would not be implemented soon.
The extensive and often referred to Koornstra, Bijleveld & Hagenzieker (1997) report not only presents the (positive) results of a meta-analysis of the available studies on the effects of DRL on road safety, but also discusses possible adverse effects, and ways of implementing DRL in non-DRL countries. The main conclusion of the report is that: "It is recommended on technical, practical and legal grounds that compulsory DRL, when implemented in the EU, should be an automatic in-vehicle DRL that uses either low beam headlights or special DRL-lamps. Because of the large safety effects from full DRL in the EU with a benefit-cost ratio of at least 1.8, it is recommended to make plans for a EU regulation on automatic in-vehicle DRL for new motor vehicles from a particular year onward. The year to be chosen is preferably decided after the political and public acceptance of the DRL-regulation has become clear. However, any acceptance of a DRL regulation probably will not emerge, unless prior to a DRL regulation, intensive DRL campaigns and social marketing of DRL in the EU, initiated by the CEC, has raised the political and public awareness of the safety effects and benefits from DRL in all countries of the EU" (Koornstra et al., 1997, p.166).
The Ministry of Transport, Public Works and Water Management of the Netherlands are in favour of implementing DRL as a technical measure consisting of automatic dedicated DRL for new motor vehicles; additionally, an automatic light-sensitive switch for dipped headlights in reduced visibility conditions is considered to be a sensible option.

2.2.6. *Spain*

Appendix 5.6 contains the answers to the DRL questionnaire for Spain. In Spain, the use of DRL is only compulsory for motorcycles. At this moment, whether or not to extend this regulation to other motorized vehicles is only a matter of consideration. If the latter measure should be introduced, the idea would be to apply it to all motorized vehicles during the entire year, but only outside built-up areas. According to the study by Robert (2000), this is due to concerns in Spain about an increase in pollution in built-up areas.
According to the respondent, currently the voluntary use of DRL in Spain is becoming more and more frequent on roads outside built-up areas, and vehicles of the traffic police have already been using DRL for a long time. Also according to the respondent of the Dirrección General de Tráfico of the Ministerio del Interior, it would "not be extremely difficult" to implement the compulsory use of DRL in Spain, except for opposition from motorcyclists and, perhaps, ecologists.

2.2.7. *Switzerland*

The answers to the DRL questionnaire for Switzerland are given in *Appendix 5.7*.
In Switzerland, the *voluntary* use of DRL was introduced in January 2002 for all motorized vehicles on all roads during the entire year in a joint campaign organized by the Swiss Federal Roads Authority, Swiss Insurance Association, automobile associations, automotive trade, public transport authorities, associations of driving school instructors, police, traffic authorities, Fonds für Verkehrssicherheit (Road Safety Fund), and

Schweizerischer Verkehrssicherheitsrat (Swiss Council for Road Safety). This was accompanied with a media campaign consisting of radio announcements before and after traffic information, posters nationwide, flyers, Internet, and Infomedia under bfu's supervision (bfu is the 'Beratungsstelle für Unfallverhütung', i.e., the Swiss Council for Accident Prevention). Since the use of DRL is recommended (and not compulsory) in Switzerland, there are no penalties for not using DRL, nor police enforcement activities, and DRL are switched on and off manually.
In surveys conducted by bfu it was found that 21% of the Swiss population would tend to be in favour of compulsory DRL for cars in 1999, while these percentages increased to 38% in 2000, 56% in 2001, and 64% in 2002. Moreover, according to bfu the actual voluntary use of DRL has, on the whole, risen from 16% in 2001 to 26% in 2002 in all weather conditions, and from 9% to 25% in good weather conditions. The aim of the bfu, however, is to achieve a voluntary use of DRL of 60% of all vehicle users (Infomedia 2-7-2002).
Opposition to the measure was expressed by some individuals in the form of letters to newspapers or in e-mails/letters to the bfu or other partners in the joint campaign.

2.2.8. *United Kingdom*

Appendix 5.8 contains the answers to the DRL questionnaire for the United Kingdom.
Clearly, the United Kingdom has no plans of implementing the compulsory use of DRL, and the issue of DRL has received virtually no public discussion. The answer on the current voluntary use of DRL in *Appendix 5.8* suggests that only cars manufactured in countries with mandatory use of DRL (mainly Volvos and Saabs) typically drive with DRL all the time, because the lights are switched on automatically. Drivers of other vehicles only turn their lights on in daytime with poor visibility conditions.
According to Robert (2000), the UK is quite concerned about the possible detrimental effects of DRL on vulnerable road users, especially since this country has a relatively higher number of accidents involving vulnerable road users (child pedestrians, for example) than other European countries.

2.2.9. *United States of America*

Appendix 5.9 discusses the situation in the United States, as we deduced from an email and documents concerning DRL that we received from the official responsible for the U.S. Federal Motor Vehicle Safety Standard (FMVSS) 108 at the National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation (NHTSA, 2002)

To summarize, the use of DRL in the U.S.A. is not compulsory, but a final rule was published in January 1993 amending Federal Motor Vehicle Safety Standard (FMVSS) 108 to explicitly allow the *voluntary* installation of DRL. This rulemaking was necessary because a multitude of conflicting state laws had the practical effect of prohibiting the installation of DRL.
General Motors began to install DRL on selected 1995 model year vehicles. By the 1997 model year, DRL was standard equipment on all General Motor vehicles sold in the U.S.A. To date, General Motors has sold more than 23 million vehicles in the U.S. equipped with DRL. General Motors, Saab,

Volvo, and Volkswagen were the first manufacturers to introduce DRL in the U.S.A.
In the U.S.A., DRL are provided in a variety of configurations. These include reduced intensity upper beams, reduced or full intensity low beams, dedicated DRL, or turn signal DRL. According to the official responsible for the U.S.A., FMVSS 108 of the NHTSA, one thing that is particularly important for public acceptance is to make sure that the DRL intensity is high enough to be conspicuous, but not so high as to be considered glaring. That is an issue that NHTSA is currently resolving, based on hundreds of complaints from the public. As a result, NHTSA is about to publish an amendment to substantially reduce the permitted intensity, which can currently be more than 3000 cd (candela). There will be an additional amendment to deal with further intensity reductions (to a maximum of 1500 cd) and some wiring and use issues. That may follow toward the end of 2003.

General Motors is opposed to the DRL photometric restrictions proposed in the amendment of NHTSA. They argue that: 1. the number of complaints about glare were overestimated because of repeats and multiple copies of letters, and because some complaints were solicited by organizations who opposed DRL in principle; 2. the few initial DRL complaints in Canada (where DRL has been mandatory since 1989) dropped to virtually zero by the early 1990's and continue to be virtually non-existent, even though they have the same photometric provisions as those specified in the current U.S. FMVSS 108.
Also, General Motors believes there is a strong general acceptance of DRL in the market. To support this, Bergkvist (2001) presents the results of surveys conducted to determine the consumers' perception of DRL as a safety feature. In a survey conducted in 1997, it was found that 23% of the respondents definitely wanted DRL implemented as a safety feature of motor vehicles. In a second survey conducted in 1998, it was found that 64% of the respondents were of the opinion that DRL is a beneficial feature, 26% that it is a neutral feature, 8% that it is a negative feature, and 2% did not respond. However, nothing is mentioned about the sample sizes used in these two surveys.
Finally, General Motors has formally petitioned NHTSA to amend the Standard to mandate the use of DRL. NHTSA has not made any decision yet on whether to act on that petition or not.

3. Conclusions

In this chapter we discuss what can be learned from the completed DRL questionnaires and from the literature mentioned in the questionnaires in terms of possible implementation scenarios for DRL. In *Section 3.1*, the reported arguments pro and con are enumerated both before and after implementation of DRL. *Section 3.2* discusses the types of media campaigns that were used during the introduction of DRL. In *Section 3.3* an overview is given of all the possible implementation scenarios that can be distilled from the completed questionnaires and the literature reported in the questionnaires. Finally, *Section 3.4* gives a summary in terms of the two objectives defined in the introduction of the present report.

3.1. Arguments pro and con

In this section we summarize the pros and cons mentioned in the questionnaires of the DRL countries both before and after DRL was legally implemented.

3.1.1. *Before implementation*

The pros and cons mentioned in the questionnaires of the DRL countries before implementation of DRL are the following:

Cons

- vulnerable road users are afraid they will be less conspicuous: Denmark (the Cyclists Federation), Norway, Canada (the Motorcycle Association), Sweden (motorcyclists)
- increased fuel usage: Denmark (in the media), Finland (individuals), Sweden (groups)
- environmental concerns: Sweden (groups)
- more frequently burned-out bulbs: Denmark (in the media), Canada (individuals)
- increased risk: Italy (individuals)
- concerns about glare: Canada

Pros

- seen as correcting a mistake in the law by motorcyclists and scooter users: Italy
- improved visibility of drivers approaching from behind: Italy (individual)
- generally well accepted; no serious opposition: Finland, Sweden

3.1.2. *After implementation*

The pros and cons mentioned in the questionnaires of the DRL countries after implementation of DRL are:

Cons

- vulnerable road users are afraid they are less conspicuous: Sweden (motorcyclists)
- increased fuel usage: Finland (individuals), Sweden (groups)

- environmental concerns: Sweden (groups)
- more frequently burned-out bulbs: Canada (individuals)
- concerns about glare: Canada (individuals)
- engine starting problems: Canada (individuals), Sweden (many individuals, due to empty batteries when forgetting to switch off the DRL when parking)
- complaints that occasional vehicles drive at night carrying DRL without tail lamps: Canada
- drivers use reduced low beams in darkness, forgetting to switch on the ordinary low beams: Sweden

Pros

- accepted by most road users and organisations, not an issue discussed in the media: Denmark
- generally well accepted; no serious opposition: Finland
- no comments and no complaints: Italy
- not an issue any more; well accepted by all except for a few individuals: Canada
- no lobbies or government parties opposed over a number of years before 2004: Israël
- well accepted and not on the political agenda: Norway
- the opposition towards DRL has been substantially reduced with time after the initial legislation; one obvious reason is the improved technology (primarily automatic switching); DRL is not a political issue, all parties seem to agree on the present legislation: Sweden

On the whole, these reactions of the DRL countries suggest that protests against the introduction of DRL by organizations and lobbies were mainly raised before the implementation of the measure; after implementation complaints seem to be expressed by individuals only, with the exception of Sweden where concerns about increased fuel usage and the environment are still shared by groups of people. Moreover, all DRL countries indicate that acceptance levels were, and are, generally high after DRL legislation was implemented, irrespective of the type of implementation scenario used.

Table 4.1 contains an inventory of all the arguments against DRL that were mentioned in the completed questionnaires as well as in the reports sent to us both by DRL and non-DRL countries, including suggested solutions to resolve these problems if DRL are proven to be effective. This list is important because these are the arguments that will have to be dealt with if the project should result in a recommendation to implement DRL in non-DRL countries of the EU countries.

It may be noted that the solutions for avoiding decreased conspicuousness of vulnerable road users (pedestrians, cyclists, mopedists and motorcyclists) mentioned in *Table 4.1* only need to be considered if it is actually proven that the use of dipped headlights during daytime indeed results in vulnerable road users being less conspicuous or more often involved in accidents. The possible second solution mentioned in *Table 4.1* for the possible problem of motorcycles being less conspicuous if DRL are implemented for all motorized vehicles (special design of motorcycle DRL) was proposed by Rumar (2003a).

Arguments against DRL	Suggestions for (partial) solutions
Reduced conspicuity of pedestrians, cyclists and mopeds	Dedicated reduced intensity DRL on cars
Reduced conspicuity of motorcyclists	1. Dedicated reduced intensity DRL on cars plus dipped headlights for motorcyclists 2. Special design of motorcycle DRL, e.g. triangular form consisting of dipped headlight plus two somewhat lower-positioned dedicated reduced intensity DRL
Glare	Dedicated reduced intensity DRL on cars
Increased fuel consumption	1. Low-energy light sources such as LED 2. Dedicated reduced intensity DRL on cars 3. Light sensitive switch for dipped headlights on cars in reduced visibility conditions
Increased CO_2 emission	1. Low-energy light sources such as LED 2. Dedicated reduced intensity DRL on cars 3. Light sensitive switch for dipped headlights on cars in reduced visibility conditions
More frequently burned-out bulbs	1. Low-energy light sources such as LED 2. Dedicated DRL bulbs 3. Reduced voltage DRL
Flat batteries	1. Warning device 2. Automatic 'off' switching
Reduced conspicuity of brake lights	No tail lights in good daytime visibility conditions
If carrying dedicated DRL, drivers forget to switch on dipped headlights in reduced visibility conditions	Light sensitive switch for dipped headlights on cars
"Masking" of unlit vehicles by lit ones	1. Automatic on-switch for all motorised vehicles in all EU countries and/or 2. Obligation of using DRL for all motorized vehicles in all EU countries

Table 4.1. *Inventory of all the arguments against DRL, and suggested solutions if DRL are proven to be effective.*

It is also interesting to note that problems with glare are only mentioned by the respondents of Canada and the USA, where much higher luminous intensities for DRL are allowed than in European countries.

The term 'dedicated reduced intensity DRL' in *Table 4.1* is defined as: DRL using lamps with an intensity somewhere between low beam headlights and parking lights. As the table indicates, the use of dedicated DRL has a number of important advantages. It allows for the minimisation of the adverse environmental effects of DRL (i.e., increased fuel consumption, increased CO_2 emission, and more frequently burned-out bulbs). It prevents flat batteries (by automatically switching off the lights when the engine is stopped). It allows for the optimisation of the luminous requirements of the DRL in terms of glare, and in terms of the possibly reduced conspicuousness of vulnerable road users. Finally, it allows for dedicated daytime tail light specifications, and can be combined with the installation of an automatic 'on' switch for the low beam headlights in reduced visibility conditions.

3.2. Media campaigns

In this section we summarize whether, and the ways in which, the implementation of DRL in DRL countries was accompanied with campaigns in the media. In the questionnaires discussed in *Section 3.1* the following types of media campaigns were mentioned:

- Spots on national television and information in the main newspapers. (Denmark)
- Cannot remember how it was introduced in the 1970's. Probably nothing very conspicuous. Later changes were routine, no campaigning either. (Finland)
- All the newspapers, television, and radio announced this implementation. In addition, for approximately one month, the police gave no tickets but only "advertisements" to drivers with no lights on when required. Now tollway companies are using various messages and boards when entering the tollway to remind that you have to switch your lights on. (Italy)
- There was a lot of public interest in the run-up to the new vehicle regulation implementation date and for some time after it, i.e. from about 1987 through 1995. Transport Canada and the provincial/territorial transportation authorities cooperatively produced and distributed a common design pamphlet and poster. The message, directed to drivers of pre-DRL vehicles, was to drive with low beam headlamps switched on at all times or to have a DRL switching kit installed for convenience. Transport Canada staff gave numerous press interviews and responses to direct requests for information from the public and other interested parties. The public (provincial) vehicle insurance corporations advertised in the media, primarily newspapers. Also, vehicle manufacturers mentioned DRL in their advertisements, particularly for models with DRL installed voluntarily before it became mandatory. (Canada)
- No media campaigns. (Czech Republic)
- Only some leaflets. (Hungary)
- The implementation of DRL was preceded by an experiment accompanied by the evaluation study, in the winter of 1989/90. There was a three-month media and roadside campaign promoting the use of DRL. Every year, during the winter period there are reminding announcements in the media. (Israël)
- Brochures were used as well as newspaper advertisement and stickers on buses. (Norway)
- All media were used to inform the public. (Sweden)

From the above, it can be concluded that the use of media campaigns in order to raise the awareness of the public concerning the use of DRL ranged all the way from no media campaigns at all in Hungary, to massive media campaigns in Canada. Moreover, since the DRL countries report not having met with much resistance and opposition against DRL after its implementation (see *Section 3.1*), there does not seem to be much that can be learned in terms of what type of media campaign would be optimal when introducing DRL in a non-DRL country.

However, the person responsible for the answers of the questionnaire for Canada advises that "it is recommended that other countries intending to implement DRL policies take steps to inform their citizenry about the basic workings of visual perception relative to the driving task, since some of the comments from the Canadian public about DRL seemed to reflect a lack of understanding of the role and importance of contrast in aiding visual perception." A similar issue is raised in Lassarre (2002), where it was found that young drivers were more inclined to accept the (recommended) use of DRL because they themselves experienced the improved visibility of other vehicles carrying DRL in practice, while elderly people were more inclined to a theoretical acceptance of DRL use based on the fact that the safety measure was recommended by the authorities (and therefore must be good).

In Canada publicity campaigns were used to raise the voluntary use of DRL to between 17.5 and 21.7% in the four years before the introduction of DRL on new vehicles. As mentioned in the Canadian answers to the questionnaire, before the implementation in 1989 "all the publicity undoubtedly helped to ensure broad acceptance for the DRL regulation. Consequently, the public generally perceived DRL as sensible."

Therefore, it is clear that, in order to raise both the understanding and acceptance level of DRL in road users, information to the public concerning the reason why DRL contribute to the improvement of road traffic safety should be an essential part of any implementation strategy.

3.3. Implementation scenarios

In terms of current type of legislation, the countries that replied to our inquiries and had implemented DRL legislation can be classified as follows:

- compulsory on all roads during the entire year: Denmark, Finland, Norway, Sweden
- compulsory on non-urban roads during the entire year: Italy, Hungary
- compulsory on all roads in winter time: Czech Republic
- compulsory on non-urban roads in winter time: Israël
- compulsory automatic on switch for DRL on all motorized vehicles: Canada.

Whereas Denmark, Finland, Norway, Italy, Hungary, the Czech Republic, Israel and Sweden introduced DRL as a *behavioural* measure, Canada implemented DRL as a *technical* measure.
However, in practice most vehicles in Denmark, Finland, Norway, and Sweden also have an automatic 'on' switch for DRL, but this is not legally required. Moreover, Canada is considering introducing the legal obligation for the *use* of DRL as well (and this was already implemented in one of their territories).

Switzerland is the only country where the use of DRL is explicitly *recommended* instead of imposed. Also, from June 1999 until July 2000 an experiment was performed involving a recommendation for the use of DRL in the French Département Les Landes.

2869

The purpose of this section is to provide a classification of all the different DRL implementation strategies discussed in the present report, as well as the arguments for and against these strategies. This classification scheme involves the following (partially nested) dichotomous factors:

- automatic (technical measure) versus manual (behavioural measure)
- gradual versus immediate and complete implementation
- if manual: voluntary versus imposed
- if manual: part of the year versus the entire year
- if manual: non-urban roads versus all roads
- if automatic: the entire car park versus new models only
- if automatic: when starting the engine versus using receptors (i.e., a "light sensitive on switch" for dipped headlights in reduced daylight conditions)
- dipped headlights versus dedicated DRL of lower intensity.

Figure 3.1 contains a schematic overview of the possible implementation strategies that can be distilled from the complemented questionnaires, as well as from the literature discussed in the present report. To this scheme we have added the names of three types of countries. Underlined countries are those countries that currently have DRL legislation (Canada, Czech Republic, Denmark, Finland, Hungary, Israel, Italy, Lithuania, Norway, Poland, and Sweden). The place of their names in *Figure 3.1* corresponds to the strategy that they used to implement DRL.

Although Lithuania and Poland did not return a filled-in DRL questionnaire (see *Table 2.1*), we were able to determine the implementation strategy that these two countries used by consulting the ECE document TRANS/WP.1/80/Rev.2 (ECE, 2003). Bold countries in *Figure 3.1* currently do not have DRL legislation for all motorized vehicles (Austria, France, Germany, the Netherlands, and Spain). Their place in the scheme is determined by plans or scenario preference if DRL should be proven to be effective, as expressed in the completed questionnaires or in the literature mentioned in the questionnaires. Finally, the third type of country is where there is currently no DRL legislation, but where the use of DRL is explicitly recommended. There is only one such country, which is Switzerland.

Therefore, *Figure 3.1* in fact provides two pieces of information at the same time. The first one is a schematic overview of the current status of DRL legislation in the DRL countries discussed in the present report; this is the part of the scheme only containing the underlined countries. The second piece of information consists of other possible implementation strategies mentioned in the questionnaires and accompanying literature of non-DRL countries.

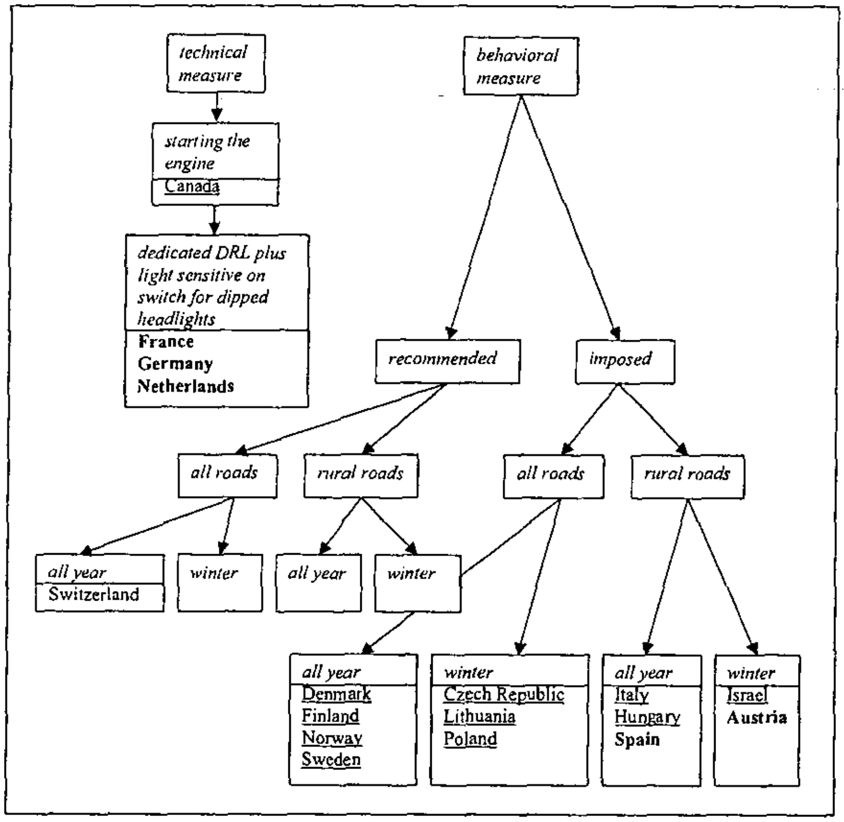

Figure 3.1. *Classification of possible DRL implementation scenarios, including those already applied in DRL countries.*
Underlined*: countries with DRL legislation.*
Standard*: countries without DRL legislation, but DRL recommended.*
Bold*: countries without DRL legislation; plans, or expressed scenario preference if DRL proven to be effective.*

The first distinction in *Figure 3.1* is that between the implementation of DRL as a technical measure versus as a behavioural measure. When implemented as a technical measure, the DRL are switched on automatically. In this case, DRL are de facto imposed on all roads during the entire year. The federal government of Canada is the only government that consistently decided for this implementation strategy, on the grounds that it would be the least costly and the most reliable long-term solution.

Figure 3.1 also shows an alternative technical measure, as discussed in France, Germany and the Netherlands. According to Robert (2000), if DRL are proven to be effective, then the implementation strategy with the largest acceptance level in France would be an automatic on switch of dedicated daytime running lights with an intensity somewhere between dipped headlights and parking lights, combined with the installation of receptors which switch on the dipped headlights in case of reduced ambient light (and automatically switch off the dedicated daytime running lights).
With a very strong emphasis on the condition that such dedicated DRL should first be proven to be effective in improving road safety, the position of

2871

the experts from Germany is identical to that of France. If the latter condition is not satisfied, however, Germany would still be interested in the separate installation of receptors which switch on the dipped headlights in reduced ambient light conditions.
The Dutch authorities also favour automatic dedicated DRL, and view the light sensitive switch for dipped headlights as a sensible option.

If technical measures are only implemented on new car models, then this implies a possibly undesirable transition period with a mixed circulation of old and new cars. If it is found that the "masking" of unlit vehicles by lit ones imposes a safety risk, such a technical measure could either be combined with a second technical measure (e.g., the installation of a DRL switching kit, as was done in Canada) and/or a behavioural measure for older car models (i.e, the mandatory use of dipped headlights as DRL).
The advantages of a technical measure are that it results in uniform behaviour, and that it allows for the implementation of the solutions mentioned in *Table 3.1*. The disadvantage, of course, is the time lapse involved before all car models are equipped with automatic DRL, whatever the type of technical measure is chosen.

If DRL is implemented as a behavioural measure, there are several options. First, the measure can be either recommended or imposed, or even first recommended and then later imposed. Second, the use of DRL can be recommended or imposed on all roads, or on some roads only (in practice, these are always roads outside built-up areas), and during the entire year or only during part of the year (in practice, this is always winter time).
Moreover, the implementation of DRL as a behavioural measure can also be executed using a gradual approach, where, for example, DRL are imposed on rural roads and in winter time only in the first year, on rural roads during the entire year in the second year, and on all roads during the entire year in the third year. Such a gradual approach was applied in Finland and Hungary, for example.
As *Figure 3.1* shows, all Scandinavian countries currently impose year-round DRL on all roads, while the Czech Republic, Lithuania, and Poland impose DRL on all roads but during winter time only, Italy and Hungary impose year-round DRL but on rural roads only, and Israel imposes DRL on rural roads and in winter time only.
Moreover, Spain expressed plans for the strategy already implemented in Italy and Hungary, while Austria expressed plans for the strategy as implemented in Israel, at least in the medium term. Finally, Switzerland is the only country where the use of year-round DRL on all roads is only recommended.

Compared to a technical measure, the advantage of a behavioural measure is that the use of dipped headlights can be imposed straight away for all motorized vehicles, thus avoiding the possible problem of mixed circulation of lit and unlit vehicles. This advantage only applies on the condition that all vehicle drivers comply to the measure. The advantage also no longer strictly applies if the use of dipped headlights is only imposed on some roads, and/or part of the year. In the latter situation the risk of mixed circulation of lit and unlit vehicles may well increase due to inconsistent behaviour.
An argument mentioned by Robert (2000) against a year round behavioural measure on all roads is that the enforcement efforts required from the authorities could well be considerably larger than in the case of a technical

measure (see *Section 2.2.3*). However, the validity of this argument is questioned by Rumar (2003b). It is his experience that enforcement of DRL in the Scandinavian countries does not necessarily come from the authorities, but is also realized through the interaction between motor vehicle drivers themselves. Just as is common practice at night, by flashing their lights drivers warn another vehicle circulating without lights during the day also, and thus the drivers themselves enforce DRL.

It is interesting to notice that, of the nine DRL countries that responded to the questionnaire, seven used a gradual approach in the implementation of mandatory DRL. Over time, DRL were gradually made mandatory for more and more types of road in Finland and Hungary, and for more and more months of the year in Finland. In Sweden, DRL were already used by the army, the railways, and some companies years before the implementation of DRL legislation for all motorized vehicles. As mentioned before, in Canada publicity campaigns raised the voluntary use of DRL, in the four years before the introduction of DRL on new vehicles, to between 17.5% and 21.7%. In Norway about one third of the motorized vehicles already used DRL voluntarily even four years before the implementation of compulsory DRL on new motorized vehicles. In the answers to the questionnaire of the Czech Republic, it is mentioned that even before implementation of DRL, its acceptance had already been quite good, especially on motorways. In Israel, the implementation of DRL in 1996 was preceded by an experiment accompanied by an evaluation study in the winter of 1989/90.

Finally, since June 2002 the use of DRL in Italy is compulsory for all vehicles on motorways (urban and rural) and primary rural highways during the entire year, while in Switzerland the voluntary use of DRL was introduced in January 2002 for all motorized vehicles on all roads during the entire year. Therefore, in the present context the latter two countries could be considered to be in the first stages of a gradual DRL implementation strategy. In fact, after we received the filled-in questionnaire from Italy, the use of DRL became mandatory on all roads outside built-up areas in that country.

Besides the importance of raising the understanding of DRL by providing information concerning its visual workings (see *Section 3.2*), such gradual implementation strategies were probably helpful in getting road users used to DRL, and in obtaining broader public acceptance for DRL legislation.

These findings, combined with the experience that most of the opposition against DRL greatly subsided in countries after DRL legislation was implemented (see *Section 3.1*), suggest that it is sensible to apply a gradual approach to the implementation of DRL in countries which currently have no DRL legislation, even though this involves a transitional period with mixed circulation of lit and unlit vehicles. Therefore, it is recommended to start any implementation strategy with an introductory period of recommended voluntary DRL usage, accompanied with media campaigns explaining why DRL contribute to the improvement of road traffic safety, thus already raising both the understanding and acceptance level of DRL in road users before DRL are made mandatory.
Moreover, since the introduction of DRL as a technical measure on new cars will result in uniform behaviour, albeit in the longer run, and moreover allows for the minimisation or even complete solution of the adverse effects used in

the arguments against DRL, it is recommended to make the installation of automatic dedicated DRL on new cars –combined with a light sensitive switch automatically activating the low beam headlights in reduced visibility conditions (and deactivating the DRL)- at least part of the DRL implementation scenarios to be developed later in the project. As concerns the technical specifications of automatic dedicated DRL on new cars, these should be made in accordance with the already existing European ECE Regulation No.87 for daytime running lights (ECE, 1993).

3.4. Summary

The first objective of the present report was to provide an inventory of the currently legislated requirements for the use of DRL in the EU and elsewhere, and how that legislation has been implemented in these countries. Such an inventory is provided in *Figure 3.1* of *Section 3.3*. The figure shows that DRL has been implemented both as a technical and as a behavioural measure. So far, the majority of DRL countries chose to impose DRL as a behavioural measure. However, most cars in the Scandinavian countries (Denmark, Finland, Norway and Sweden) are sold with an automatic DRL switch as well. The countries which currently have legislation on the use of DRL can be further distinguished in whether they impose DRL during the entire year or in winter time only, and on all roads or on rural roads only.

The second objective of the present report was to assess what can be learned from the existing DRL implementations, so as to take these findings into account in the later development of realistic implementation strategies. When setting up European guidelines for the implementation of DRL, it is important to take the arguments against DRL into account. These arguments are enumerated in *Table 4.1* of the present report. Since most of the adverse effects mentioned in these arguments can be minimised or even completely solved by the implementation of DRL as a technical measure, it is recommended to make the installation of automatic dedicated DRL on new cars – combined with a light sensitive switch automatically activating the low beam headlights in reduced visibility conditions (and deactivating the DRL) - at least part of the DRL implementation scenarios to be developed later in the project.

In DRL countries the use of media campaigns during the introduction of DRL was found to range all the way from no media campaigns at all in Hungary to massive media campaigns in Canada. Since all DRL countries indicate not having met with much resistance and opposition against DRL after its implementation, there does not seem to be much that can be learned in terms of what type of media campaign would be optimal when introducing DRL in a non-DRL country. However, according to the person responsible for completing the questionnaire in Canada, "it is recommended that other countries intending to implement DRL policies take steps to inform their citizenry about the basic workings of visual perception relative to the driving task, since some of the comments from the Canadian public about DRL seemed to reflect a lack of understanding of the role and importance of contrast in aiding visual perception."

Most DRL countries used a gradual approach to the implementation of DRL, either by encouraging the voluntary use of DRL before the introduction of

DRL legislation, or by a gradual extension of compulsory DRL usage over more and more types of roads, over more and more months of the year, and/or for more and more types of road users.
Such gradual implementation strategies allow road users to gain personal experience in the visual workings of DRL, thus probably also contributing to obtain broader public acceptance for DRL legislation.

These findings, combined with the experience that most of the opposition against DRL greatly subsided in countries after DRL legislation was implemented, lead us to recommend that the implementation of DRL in non-DRL countries is preceded with a period of recommended DRL usage, accompanied with media campaigns clearly explaining how the visual workings of DRL contribute to the improvement of road traffic safety.

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Robert, C. (2000). *La question de l'allumage des feux de croisement de jour. Rapport pour le Ministre de l'équipement, des transports et du logement.* Conseil Général des Ponts et Chaussées (CGPC), Paris. [In French]

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2877

Appendices

1. *Questionnaire for DRL countries*

2. *Questionnaire for non-DRL countries*

3. *Names of experts and institutes contacted*

4. *Answers to the questionnaire for DRL countries*
   - *App. 4.1 Denmark*
   - *App. 4.2 Finland*
   - *App. 4.3 Italy*
   - *App. 4.4 Sweden*
   - *App. 4.5 Canada*
   - *App. 4.6 Czech Republic*
   - *App. 4.7 Hungary*
   - *App. 4.8 Israel*
   - *App. 4.9 Norway*

5. *Answers to the questionnaire for non-DRL countries*
   - *App. 5.1 Austria*
   - *App. 5.2 Belgium*
   - *App. 5.3 France*
   - *App. 5.4 Germany*
   - *App. 5.5 The Netherlands*
   - *App. 5.6 Spain*
   - *App. 5.7 Switzerland*
   - *App. 5.8 United Kingdom*
   - *App. 5.9 United States of America*

Appendix 1 Questionnaire for DRL countries

A. DRL Legislation

1) When have Daytime Running Lights (DRL) become compulsory by law in your country (month and year)?

....
....
....

2) To which type(s) of road users does DRL legislation apply (all motorised vehicles?, motorcycles only?, cars only?, etc.)?

....
....
....
....
....

3) On which type(s) of roads is DRL compulsory in your country (all roads?, rural roads only?, etc.)?

....
....
....

4) During which months of the year is DRL compulsory (the whole year?, only certain months?, if so: which months of the year?)?

....

5) What type of lights for DRL are used in your country (dipped?, straight?, dimmed city lights?, etc.)?

....

6) Are the DRL lights switched on automatically when starting the motor, or can they be turned on or off at will by the driver of the vehicle?

....
....

7) Is there a special type of light bulb used for DRL? If so what type of bulb is this?

....
....
....

B. Implementation of DRL

8) Was the implementation of DRL accompanied with some form of introduction campaign in the media? If so, what kind of campaign was used (newspaper advertisements?, television advertisements?, advertisements on billboards along roads?, etc.)?

....
....
....

9) If appropriate, what kinds of penalties or fines are issued in your country for road users not carrying DRL when they should be carrying it?

....
....
....

10) Are you aware of any police enforcement activities especially aimed at carrying DRL in your country? If so, what type of activities?

....
....
....

C. Acceptance of DRL

11) Is there anything you could mention about the acceptance of DRL by the public, lobbies and/or government parties in your country before the implementation of DRL (in terms of opposition or cooperation by certain (groups of) road users, lobbies or government parties)?

....
....
....

12) And after DRL was implemented?

....
....
....

13) Are there any official or unofficial evaluation reports available concerning the acceptance level of DRL in your country (either before and/or after implementation)? If so, could you supply us with the name(s) of the source(s)?

....
....
....

D. National expertise on DRL

14) Are you aware of any other national experts -besides yourself- on DRL in your country that we could consult on matters of legislation and acceptance of DRL?

....

....

....

Appendix 2 Questionnaire for non-DRL countries

A. DRL Legislation

1) Are there any plans of making Daytime Running Lights (DRL) compulsory by law in your country? Or were there plans for making DRL compulsory by law in your country in the past, but which have not been implemented?

....

....

If the answer to Question 1 is "No", you may ignore Questions 2 through 7, and continue with Question 8.

2) If so, to which type(s) of road users is/was DRL planned to be applied (all motorised vehicles?, motorcycles only?, cars only?, etc.)?

....

....

....

....

3) On which type(s) of roads is/was DRL planned to be made compulsory in your country (all roads?, rural roads only?, etc.)?

....

....

....

4) During which months of the year is/was DRL planned to be made compulsory (the whole year?, only certain months?, if so: which months of the year?)?

....

5) What type of lights for DRL are/were planned to be used in your country (dipped?, straight?, dimmed city lights?, etc.)?

....

....

6) Are/Were the DRL lights planned to be switched on automatically when starting the motor, or will they be turned on or off at will by the driver of the vehicle?

....

....

7) Are/Were there plans for using a special type of light bulb for DRL? If so what type of bulb will/would this be?

....

....

B. Voluntary use of DRL

8) To your knowledge, is there currently any amount of *voluntary* use of DRL by road users in your country? If so, could you provide us with any information you have on which and how many road users voluntarily carry DRL, on what type of roads, and in what kind of circumstances?

....

....

....

C. Acceptance of DRL

9) Is there anything you could mention about the acceptance of the possible future implementation of DRL by the public, lobbies and/or government parties in your country about the possible future implementation of DRL (in terms of opposition or cooperation by certain (groups of) road users, lobbies or government parties)?

....

....

10) Are there any official or unofficial evaluation reports available concerning the acceptance level of the possible future implementation of DRL in your country? If so, could you supply us with the name(s) of the source(s)?

....

....

D. National expertise on DRL

11) Are you aware of any other national experts -besides yourself- on DRL in your country that we could consult on matters of legislation and acceptance concerning a possible future implementation of DRL in your country?

....

....

Appendix 3 Names of experts and institutes contacted

Klaus Machata
Austrian Road Safety Board
Austria

Karel Hofman
Directoraat-generaal Mobiliteit en Verkeersveiligheid
Belgium

James G. White
Vehicle Systems Research Division (ASFBA)
Road Safety and Motor Vehicle Regulation Directorate
Transport Canada
Canada

Jaroslav Heinrich
Road Traffic Technology, CDV
Czech Republic

Lars Klit
Road Safety and Transport Agency
Denmark

Veli-Pekka Kallberg
VTT Technical Research Centre of Finland
Finland

Sylvain Lassarre
French National Institute for Transport and Safety Research
France

Ursula Einfelder
Bundesministerium für Verkehr, Bau- und Wohnungswesen
Germany

Centre for Research and Technology Hellas, CERTH
Greece

Peter Holló
Institute for Transport Sciences Ltd (Kti), Road Safety and Traffic Engineering
Hungary

Department Of The Environment
Ireland

Victoria Gitelman
Technion - Israel Institute of Technology, Haifa
Israel

Francesca La Torre
University of Florence
Italy

Vidmantas Pumputis
Lithuanian Road Administration
Lithunia

Rob Wegman
Ministry of Transport, Public Works and Water Management
The Netherlands

Richard Muskaug
Road Safety Section
Roads Directorate
Norway

Krzystof Jamrozik
Ministerstwo Infrastruktury
Poland

LNEC - Laboratório Nacional de Engenharia Civil
Portugal

Mónica Colás
Ministerio del Interior, Dirección General de Tráfico
Spain

Kåre Rumar
University of Uppsala, Department of Psychology
Sweden

Ueli Salvisberg
Beratungsstelle für Unfallverhütung (BFU)
Switzerland

Jeremy Broughton
TRL - Transport Research Laboratory
UK

Richard Vaniderstine
National Highway Traffic Safety Administration
USA

Appendix 4 Answers to the questionnaire for DRL countries

App. 4.1 Denmark

Legislation	
Date of introduction	1 October 1990. At that time it had already been mandatory for motorcycles for some years.
Type of road users	All motorised vehicles. Some motor driven vehicles are not equipped with lights, and for these DRL is not required.
Types of roads	All roads.
Months of the year	The whole year.
Type of light	The following types of light are allowed as DRL: dipped headlights, front fog lamps, dipped headlights with reduced voltage (11V or 12V for vehicles with 24V) or special DRL lamps. In all cases also the rear lamps shall be used. When dipped-beam lamps or front fog lamps are used lamps for marking must also be switched on. Dipped headlights seem to be used the most often.
DRL lights switched on automatically?	There are no requirements on how to switch on DRL. However, most cars are sold with an automatic on switch.
Special type of light bulb for DRL?	No. For DRL-lamps an intensity between 400 and 1200 cd is required. Lamps with an effective consumption between 15 and 21 W are accepted in all cases.
Implementation	
Media campaigns?	Spots on national television and information in the main newspapers.
Penalties on not carrying DRL	500 Dkr (about 65 euro).
Police enforcement?	No. The usage rate seems to be very high (my guess: > 95%). It is not likely that special police campaigns would be cost effective. However, in the first year after the introduction some campaigns were made.
Acceptance	
Before implementation	When first discussed in the Danish Road Safety Commision there was a broad acceptance. Later the Danish Cyclists Federation changed their mind and opposed against the introduction of DRL. In the media there was some debate on the costs for car owners: increased fuel usage and more frequently burned out bulbs.
After implementation	Today DRL seems to be accepted by most road users and organisations. DRL is not an issue discussed in Danish media. There seems to be an acceptable to high usage rate.
Evaluation reports	Not to my knowledge.
National expertise	
Any other experts?	No – it is not a big issue in Denmark!

App. 4.2 Finland

Legislation	
Date of introduction	1972: Use of DRL became compulsory for motor vehicles for the five winter months (November-March). 1973: Compulsory use was extended to cover seven months from September to March (included). 1982: DRL became compulsory for the whole year outside built-up areas (which are marked by road signs). May 1997: DRL became compulsory in built-up areas, too.
Type of road users	All motor vehicles.
Types of roads	All roads.
Months of the year	The whole year.
Type of light	Dipped headlights or specific DRL.
DRL lights switched on automatically?	In most vehicles DRL are automatically switched on when the motor is started. Manually operated DRL are acceptable, too.
Special type of light bulb for DRL?	In specific DRL, yes. "DRL must emit diffused light, so that they do not glare or disturb other road users". Bulbs: ?, reference is made to E rule no. 7/02. If dipped headlights are used as DRL, normal bulbs for headlights.
Implementation	
Media campaigns?	Cannot remember how it was introduced in the 1970's! Probably nothing very conspicuous. Later changes were routine, no campaigning either.
Penalties on not carrying DRL	Penalties are rare. If issued a petty fine (fixed penalty, max 200 euro) is most likely.
Police enforcement?	No enforcement targeted especially at use of DRL. Enforced in connection of normal police enforcement.
Acceptance	
Before implementation	Generally well accepted. No serious opposition. Some questions raised by individuals (no organisation opposed) about the cost (effect on fuel consumption).
After implementation	Same as above.
Evaluation reports	Effects on road accidents of recommended and compulsory use of DRL in Finland. VTT Road and Traffic Laboratory. Research report 64/1976. Marrkku Salusjärvi (VTT), Kjell Andersson (VTI), Göran Nilsson (VTI). In Finnish. The same in Swedish: VTI Rapport nr. 102/1976.
National expertise	
Any other experts?	No need for help from outside VTT, not at this stage anyway. Should we later need help regarding specific questions, I believe we (Juha and I) know whom to ask.

App. 4.3 Italy

Legislation	
Date of introduction	June 2002.
Type of road users	All vehicles on motorways (urban and rural) and primary rural highways. For motorcycles and scooters DRL are mandatory on all roads (urban and rural).
Types of roads	See answer above (depends on type of vehicle)
Months of the year	The whole year.
Type of light	We have 3 type of lights but I do not know the English names: * "position lights"; * "normal running lights" (which are the ones that you have to switch on to drive in the night or in motorways or primary rural highways); * "high intensity lights (probably your straight lights)" these should never be used if another vehicle is coming towards us as he will be flashed by our lights. There are needed only for very dark roads. We also have "anti-fog light" but these should be used only when driving in the fog.
DRL lights switched on automatically?	No: You have to switch them on yourself (also because you do not need them on all roads).
Special type of light bulb for DRL?	-
Implementation	
Media campaigns?	All the newspapers, tv and radio announced this implementation. In addition for approximately 1 month the police gave no tickets but only "advertisements" to drivers with no lights on when required. Now tollway companies are using variable messages and boards when entering the tollway to recall that you have to switch your lights on.
Penalties on not carrying DRL	Now you only get a fine (I don't know the exact amount). In June 2003 we will have the new system with "driving points". Out of the initial amount of 20 points you will have 2 point removed if you do not have your lights on when required (4 if your licence is less then 5 years old).
Police enforcement?	See answer to 'Media campaigns'.
Acceptance	
Before implementation	We had someone claiming that this will cost 1 euro per year per person more and multiplying this for the number of persons in Italy this makes a huge amount of money ..... I leave to you to decide how seriously this has to be taken. There was also someone claiming that this doesn't improve safety while, on the opposite, this will increase the risk. No data were offered to support this assumption so it did not get much credit. Personally I like them because you see much better the drivers arriving behind you. For motorcycles and scooters this was seen as solving a mistake in the law because everybody knew it was safer and all the experts kept on suggesting to switch on the lights also in daytime (and I always did so) but you could get a fine for that, before June 2002.
After implementation	No comments and no complains, as far as I know. I never heard any discussion on this.
Evaluation reports	As far as I know there is none.

National expertise	
Any other experts?	I'm afraid I would not define myself as an expert on DRL but an expert on road safety, if you wish. The person I would contact is Dr. Eng. Francesco Mazziotta of the Italian Ministry for Transportation and Infrastructures. For sure he is very much expert in transportation related legislation .... But unfortunately he doesn't use very much the e-mail. You can write him at: Ministero delle Infrastrutture e dei Trasporti Piazzale Porta Pia, 1 00198 – Roma – Italy

App. 4.4 Sweden

Legislation	
Date of introduction	1977, I believe in the Fall.
Type of road users	To all motorized vehicles.
Types of roads	On all roads.
Months of the year	The whole year.
Type of light	Most common DRL are standard low beams, but reduced low beams, special DRL lights and fog lights are also allowed.
DRL lights switched on automatically?	Automatic switching is standard on most modern cars, however that is not compulsory and on some old cars and on tourist cars driver switching is still normal.
Special type of light bulb for DRL?	No, there is no special light bulb used for DRL.
Implementation	
Media campaigns?	DRL was used as one of the measures to reduce crash probability already during our switch over from left to right hand traffic 1967. In the following years DRL was used by the army, the railways and some companies in order to enhance road safety. Therefore the public was used to DRL and the campaigning was not as strong as would have been necessary without that history. But all media were still used to inform the public.
Penalties on not carrying DRL	The fine is 400 Swedish crowns (about 45 EUR).
Police enforcement?	Initially there was some enforcement. But presently the automatic switching makes enforcement unnecessary. During the first years of DRL legislation reduced low beams were very common. Then there was some police enforcement of drivers using these reduced low beams in darkness.
Acceptance	
Before implementation	DRL is not a political issue, all parties seem to agree on the present legislation. However, there are always some groups who are of the opinion that anybody who cannot see a motor vehicle in full daylight should not have a driver license, other groups are of the opinion that the environmental damage and petrol consumption of DRL is a larger disadvantage than the reduced collisions. Motorcyclists often oppose general DRL because they would like to be alone having DRL.
After implementation	Because the automatic switching was unusual when the DRL was introduced, many individuals complained about dead batteries (because they had forgotten to turn off the lights when they parked). The opposition towards DRL has been substantially reduced with time after the initial legislation. One obvious reason is the improved technology (primarily automatic switching). Presently the main opposition is focused on the negative environmental effects of DRL. Many motorcyclists are still negative.
Evaluation reports	There were some studies in the beginning. However, I do not have them available. One study is referenced in my DRL report UMTRI-2003-11 (Engdahl, B 1976). There were several evaluation studies carried out concerning the effect of DRL on crashes. I think you have referenced most of them with the exception of Helmers (1988) and Stig Danielsson (????). The first one is referenced in my report, the second one I believe exists but do not have available.
National expertise	
Any other experts?	Lennart Dellby, Volvo, Gothenburg; Goran Andersson, Swedish Road Administration, Borlange; Goran Nilsson, VTI; Gabriel Helmers, VTI.

App. 4.5 Canada

Legislation	
Date of introduction	Automatic DRL systems were made compulsory on new vehicles manufactured from 1 December 1989 onwards. The regulation, actually an amendment to CMVSS 108, was published in *Canada Gazette Part II* on 2 September 1987. Link to regulation on TC website: http://info/acts-regulations/GENERAL/M/mvsa/regulations/mvsrg/100/mvsr108.html
Type of road users	The 1989 regulation applies to all new "4-wheeled" vehicles - passenger cars, passenger vans, sport-utility vehicles, buses, trucks, cargo vans and motor homes. Automatic operation of the headlamp and rear position (tail) lamp of new motorcycles sold in Canada has been compulsory since 1975. Thus, effectively, all motorized vehicles sold in Canada and manufactured after 1 December 1989 have automatic DRL.
Types of roads	The brief answer is that in practice however, DRL is used on all types of roads. DRL is automatically activated (see response to question on 'DRL lights switched on automatically?') and it is not possible for the driver to switch it off. Therefore, almost all vehicles except for very old ones operate with lights on at all times. The longer answer is that the use of DRL is not actually compulsory in most places. That is because, with one exception (see answer to question on 'Penalties for not carrying DRL'), provincial and territorial governments have not yet introduced laws requiring lights to be switched on in daytime, except during inclement weather. (The provinces and territories regulate road users and road use, including the licensing of drivers and vehicles, whereas the federal government only regulates vehicle safety through laws applying to manufacturers and importers.) In fact, DRL is generally maintained in good working order. Provincial/territorial laws require that all federally-regulated safety equipment, including DRL, must work properly when a used vehicle is sold to a new owner.
Months of the year	DRL are used year-round because the systems are automatic.
Type of light	CMVSS 108 specifies the following types of DRL: • low beam headlamps at normal light intensity, • low beam headlamps at reduced light intensity, • high beam headlamps at reduced light intensity, • turn signals, • brighter parking lamps, • fog lamps, and • completely separate DRL units. The various DRL types have been found to be bright enough to provide the essential conspicuity without causing discomfort glare. Technical requirements for the different types are given in CMVSS 108: http://info/acts-regulations/GENERAL/M/mvsa/regulations/mvsrg/100/mvsr108.html.
DRL lights switched on automatically?	The switching requirements are as follows: DRL must be on whenever the engine is operating and the master lights switch is in any position other than "headlamps on". This requirement effectively forbids override switches on new vehicles. DRL must switch off automatically when headlights are switched on. Optional "DRL off" conditions: (a) Automatic transmission in Park or Neutral, (b) parking brake applied, (c) during the interval between engine start and vehicle first being set in motion.

Special type of light bulb for DRL?	There are no special, preferred or obligatory bulbs for DRL. The DRL function is almost always fulfilled by the headlamps or direction indicators, using the normal bulbs. The regulations allow headlamps used as DRL to operate at a reduced voltage, which greatly extends the bulb life. Reduced-voltage DRL is very common on new vehicles.
Implementation	
Media campaigns?	There was a lot of public interest in the run-up to the new vehicle regulation implementation date and for some time after it, i.e. from about 1987 through 1995. Transport Canada and the provincial/territorial transportation authorities cooperatively produced and distributed a common design pamphlet and poster. The message, directed to drivers of pre-DRL vehicles, was to drive with low beam headlamps switched on at all times or to have a DRL switching kit installed for convenience. Transport Canada staff gave numerous press interviews and responses to direct requests for information from the public and other interested parties. The public (provincial) vehicle insurance corporations advertised in the media, primarily newspapers. Also, vehicle manufacturers mentioned DRL in their advertisements, particularly for models with DRL installed voluntarily before it became mandatory.
Penalties on not carrying DRL	None of the provinces/territories except the Yukon Territory have introduced specific laws requiring drivers to use DRL, so there are no penalties either. In the Yukon, headlamps or DRL must be used on all roads outside of towns. The fine for non-use is about 60 Euros.
Police enforcement?	We are not aware of any specific enforcement activities targetting the use of DRL on the roads. Transport Canada is responsible for enforcing the DRL requirements on new vehicles. The department purchases between 50 and 100 vehicles every year and tests them for compliance with many different CMVSS. Many other vehicles are audited through visits to manufacturers. Failure in any tests or inspections conducted either by Transport Canada or manufacturers may indicate the presence of a safety defect. Transport Canada also investigates vehicle defect complaints from consumers. When it is determined that a safety defect exists, the *Motor Vehicle Safety Act* requires manufacturers to advise owners of affected vehicles of the steps needed to remedy the defect. Several recalls have been made to replace DRL switching modules that failed or provided insufficient voltage. Photometric problems with the lamps themselves are rare.
Acceptance	
Before implementation	There was some voluntary use of headlamps in daytime in Canada, particularly on highways, at least since the 1960's. Many bus and truck fleets adopted policies to drive with headlamps on at all times to improve safety. Following upon the research and regulatory experience in Finland and Sweden in the early 1970's, Transport Canada began its own research into the effects of DRL on visual perception in 1975. The research clearly showed that headlamps were effective in improving visual detection distances, and the effect increased as ambient light level decreased. The federal Minister of Transport recommended in 1982, as a first step towards DRL, that the provinces and territories extend the mandatory lights-on period by two hours, i.e. from one half hour after sunset to one half hour before sunset, with a corresponding change at dawn. The subsequent regulatory changes played a role in sensitizing the public to the potential to improve safety through the simple means of switching on headlamps. After reviewing the evidence of collision benefits, the federal Minister

of Transport and his provincial and territorial counterparts agreed in October 1985 to work towards a Canada-wide program for the use of DRL. The federal government agreed to pursue development of a new vehicle regulation as the least costly and most reliable long-term solution.

It was obvious that all vehicles on the road should have DRL or switched-on headlamps to maximize the safety benefits and minimize the "masking" of unlit vehicles by lit ones. Therefore the provinces and territories, assisted by the federal government, undertook publicity campaigns stressing the safety merits of daytime lights use.

To ensure that DRL systems would be kept operational as vehicles age, and to reduce the risk of "masking" of unlit vehicles in certain situations, Transport Canada encouraged the provincial authorities to consider mandating daytime lights use for all vehicles even before the federal regulation for DRL on new vehicles took effect. In 1987, the Yukon Territory became the first Canadian jurisdiction to introduce a daytime lights-use law. The other jurisdictions have preferred not to follow until such time as nearly all vehicles are DRL-equipped. (About 75 percent of vehicles are now equipped with DRL.)

Transport Canada measured the daytime lights usage in several annual traffic surveys beginning in 1981, when 10.3 percent of vehicles were operated with lights on in daytime. Publicity campaigns raised the voluntary lights usage in daytime, in the four years (1986-89) before introduction of DRL on new vehicles, to between 17.5 and 21.7 percent.

Insurers also supported DRL with publicity of various kinds. Of particular note was Saskatchewan Government Insurance's "Lights on for Life" campaign. This initiative included newspaper and television advertising, message signs on highways, publicity materials such as brochures, stickers, key fobs, and information delivered by post, for example with licence renewal notices. Another notable DRL campaign was carried out, somewhat surprisingly, by a lifestyle magazine.

The publicity noted above undoubtedly helped to ensure broad acceptance for the DRL regulation. Consequently, the public generally perceived DRL as sensible, although there were some concerns about glare. These concerns may have stemmed from incorrect aiming of headlamps on some vehicles, or the inadvertent use of high beam headlamps by some drivers who were unaware they had selected the incorrect beam.

DRL did not become a political issue. None of the political parties at the federal or provincial/territorial levels opposed it. There was not a lot of reaction from lobby groups, although some (but not all) vehicle manufacturers initially opposed the proposed regulation. The Canadian Automobile Association supported DRL. The Canadian Motorcycle Association initially opposed DRL on the basis that motorcycles would become relatively less conspicuous, even though motorcycles had been equipped with automatic headlamp systems since 1975 and thus were on an equal basis to DRL vehicles. However, there was little opposition from individual motorcyclists, perhaps because they recognized the benefit to themselves of seeing other vehicles better.

Some of the comments from the public about DRL seemed to reflect a lack of understanding of the role and importance of contrast in aiding visual perception. Some people thought that clear vision (usually expressed as an ability to see distant objects) somehow gave them a faultless ability to discern moving vehicles in visually complex surroundings including multiple targets. It is recommended that other countries intending to implement DRL policies take steps to

	inform their citizenry about the basic workings of visual perception relative to the driving task.
After implementation	DRL is not an issue any more. It is well accepted by all except a few who object to glare or see DRL as unnecessary government intervention in the driving process. The department receives few if any complaints about bulbs burning out, engine starting problems, etc. There have been some complaints that rear position lamps (tail lamps) should be automatically activated with the DRL. CMVSS 108 allows tail lamps to be either on or off with DRL – in fact, vehicles with both arrangements are on the market. The occasional vehicle can be noticed at night being driven without tail lamps. Usually the driver notices, after a short distance, that the instrument panel is dark or that the DRL do not illuminate the road well, and so switches on the headlamps and position lamps.
Evaluation reports	Transport Canada has not conducted any official research on the public acceptance of DRL. The department has carried out research and published reports about the effects of DRL on collisions. These are listed in the references of the attached document, and are available by contacting Vehicle Systems Research Division.
National expertise	
Any other experts?	Marcin Gorzkowski Senior Regulatory Development Engineer Road Safety and Motor Vehicle Regulation Directorate Transport Canada 330 Sparks Street Ottawa, ON K1A 0N5 E-mail: gorzkom@tc.gc.ca Tel. +1-613-998-1967 Fax +1-613-990-2913 Additional general information on DRL in Canada is contained in the enclosed .pdf file.

App. 4.6 Czech Republic

Legislation	
Date of introduction	From 1982 motorcyclists only . From January 2001 all users in so called winter time.
Type of road users	1982: motorcyclists during the whole year. 2001: all users in winter time.
Types of roads	Both acts are for all roads.
Months of the year	Motorcyclists the whole year, others in winter time only (mostly from the last Sunday in September till the last Sunday in March).
Type of light	Need a bit more time to check that I am not so familiar with this specific terminology.
DRL lights switched on automatically?	They can be turned on or off at will by the driver of the vehicle.
Special type of light bulb for DRL?	There are no special regulations comparing to other European countries.
Implementation	
Media campaigns?	Not at all.
Penalties on not carrying DRL	It may be very different (from ca. 7 Eu up to 70 Eu).
Police enforcement?	The enforcement is applied mostly in the beginning of October, where it comes to the force again.
Acceptance	
Before implementation	Even before implementation the acceptance has been quite good especially on motorways.
After implementation	Compared to other rules compliance is very high (certainly above 95%).
Evaluation reports	No.
National expertise	
Any other experts?	Mr. Jaroslav Tesarik at the Police Directorate of the Czech Republic.

App. 4.7 Hungary

Legislation	
Date of introduction	Dipped beam at daytime: 1984. 02. for motorcycles – on all roads 1993. 03. for automobiles (i.e.: passenger cars, buses, goods vehicles) – on rural main roads 1994. 06. for automobiles, agricultural tractors, slow motion vehicles and mopeds (if the last two categories have passing lamp) – on all rural roads. 1995. 12. for mopeds, equipped with passing lamp – on all roads 2001. 05. special DRL of automobiles can be used alternatively.
Type of road users	Presently to all power-driven vehicles (motorcycles, automobiles, agricultural tractors, slow motion vehicles) and mopeds. To rail-borne vehicles this decree is not applied, but internal regulation prescribes the use of DRL.
Types of roads	On rural roads only; except for motorcycles (from 1984) and mopeds (from 1995) which are obliged to use DRL on all roads.
Months of the year	Throughout the year.
Type of light	Generally dipped beam; special daytime running lamp is permitted in the case of automobiles.
DRL lights switched on automatically?	Manual switching on and off.
Special type of light bulb for DRL?	No special requirement.
Implementation	
Media campaigns?	Only some leaflets.
Penalties on not carrying DRL	Practically there is no enforcement. Hopefully it will be considered in the framework of the further developed point demerit system.
Police enforcement?	No. There are other important offences (speeding, non wearing of safety belt, driving under the influence of alcohol) which also need better police enforcements.
Acceptance	
Before implementation	The rate of DRL-users is continuously observed and measured as an important road safety performance indicator (by road categories).
After implementation	See previous question.
Evaluation reports	Péter Holló: Changes in the legislation on the use of daytime running lights by motor vehicles and their effect on road safety in Hungary, Accid. Anal. and Prev., Vol. 30, No.2, pp. 183-199, 1998.
National expertise	
Any other experts?	No.

App. 4.8 Israel

Legislation	
Date of introduction	In 1996.
Type of road users	All motorised vehicles.
Types of roads	a) For a two-wheeled vehicle, a taxi, a bus & a commercial vehicle – on all roads b) For all other vehicles – on inter-urban roads
Months of the year	Between the 1st of November and the 31st of March.
Type of light	Headlamps - dipped lights (low beam).
DRL lights switched on automatically?	At will by the driver.
Special type of light bulb for DRL?	The regular one – headlamps.
Implementation	
Media campaigns?	The implementation of DRL was preceded by an experiment accompanied by the evaluation study, in winter 1989/90. There was a 3-month media and road-side campaign promoting the use of DRL. Every year, during the winter period there are reminding announcements in the media.
Penalties on not carrying DRL	There are fines of 100/ 250 NIS (NIS - New Israeli Shekel; $1 = 5 NIS), and penalty points.
Police enforcement?	DRL enforcement presents a part of regular police enforcement. Besides, from time to time, the police carries out one-two day blitz operations on specific issues, including DRL.
Acceptance	
Before implementation	Field observations demonstrate high level of public acceptance; even in the summer period, some part of vehicles continues using DRL.
After implementation	No lobbies or government parties opposed the DRL, over the last years.
Evaluation reports	"The use of daytime running lights during the winter months – follow up and evaluation", by Hocherman I. and Hakkert S. Research report No. 91-160, TRI, Technion, 1991 (in Hebrew).
National expertise	
Any other experts?	Dr. Dan Link from the National Road Safety Authority (E-mail: noaba@mot.gov.il).

2897

App. 4.9 Norway

Legislation	
Date of introduction	Compulsory on new cars from 1 January 1985, and on all cars from 1 April 1988.
Type of road users	All motorised vehicles.
Types of roads	All roads.
Months of the year	The whole year.
Type of light	Dipped lights or special DRL lamps.
DRL lights switched on automatically?	Up to 1994 they had to be switched on automatically when one started the engine. Since we entered the EEE in 1994 this rule was revised. Now the lights have to be lit, but they don't need to be switched on automatically.
Special type of light bulb for DRL?	No.
Implementation	
Media campaigns?	Brochures were used as well as newspaper advertisement and stickers on buses.
Penalties on not carrying DRL	A fine of 1000 NOK is applied.
Police enforcement?	No.
Acceptance	
Before implementation	Pedestrians, cyclists and motorcyclists were afraid that they would not be seen when DRL was introduced. Otherwise I can not remember any particular opposition.
After implementation	The measure is well accepted and it is not on the political agenda.
Evaluation reports	The use of DRL has been assessed and it was 30-35% in 1980-81, then it was 60-65% in 1984-85 and 90-95% in 1989-90. Today it is close to 100%.
National expertise	
Any other experts?	Dr. Rune Elvik at the Institute of Transport Economics.

Appendix 5 Answers to the questionnaire for non-DRL countries

App. 5.1 Austria

Legislation	
Are/were there any plans?	There have been several attempts to launch DRL, the latest one in 2002.
Type of road users	DRL is already mandatory for all motorised 2wheelers on all types of roads on all times. The plan was to extend DRL to powered four-wheelers.
Types of roads	The plan was rural roads and motorways (everywhere except urban areas).
Months of the year	The plan was winter time (according to European summer time regulations): late October till late March .
Type of light	Dipped beam, but according to the Austrian Road Safety Programme, the implementation of ECE R87 is supported at European level.
DRL lights switched on automatically?	No plans for automatic solution.
Special type of light bulb for DRL?	According to the Austrian Road Safety Programme 2002-2010, the implementation of ECE R87 is supported at European level.
Voluntary use	
Current status on voluntary use?	KfV-Observations 2001 (31.000 Cars): 25,8% DRL in bright sunshine, 51,9% in cloudy weather, 72,8% in rainy weather.
Acceptance	
Acceptance level of possible future implementation	KfV strongly supports DRL, whereas Auto Clubs (and many others) are opposed. This was the reason for the rejection of the draft law in 2002.
Evaluation reports	KfV-Survey (n=1000) December 2002: 75% of population think that DRL is a good or very good safety measure.
National expertise	
Any other experts?	Legislation: Christian Kainzmeier, Bundesministerium für Verkehr, Innovation und Technologie, Radetzkystraße 2, 1030 Wien, Christian.KAINZMEIER@bmvit.gv.at

2899

App. 5.2 Belgium

Legislation	
Date of introduction	March 1984.
Type of road users	Two wheeled motorbikes and motorcycles have to carry a dipped head light and red rear light all the time.
Types of roads	All roads.
Months of the year	The whole year.
Type of light	Dipped head light and red rear light.
DRL lights switched on automatically?	Neither in the Road Traffic Regulations nor in Technical Regulations is it regulated that the lights should be switched on automatically, i.e., when the motor is started. Both options are therefore possible.
Special type of light bulb for DRL?	No.
Implementation	
Media campaigns?	I suspect that these new regulations were mentioned on television and in the newspapers at the time, but I can't provide any more information since it's such a long time ago.
Penalties on not carrying DRL	This is considered to be a serious offence and can therefore be punished with a fine of 50 to 500 euro or a prison sentence of 8 days to 1 month.
Police enforcement?	I don't know of any special actions concerning the assessment of such offences.
Acceptance	
Before implementation	-
After implementation	-
Evaluation reports	I don't think so.
National expertise	
Any other experts?	-

App. 5.3 France

Legislation	
Are/were there any plans?	No.
Type of road users	NA
Types of roads	NA
Months of the year	NA
Type of light	NA
DRL lights switched on automatically?	NA
Special type of light bulb for DRL?	NA
Voluntary use	
Current status on voluntary use?	In the Département des Landes during an experiment, 89% of drivers have declared to be in favour of voluntary use of DRL. See INRETS research report 244 (2002) by S. Lassarre: Évaluation de l'expérimentation des feux de croisement dans les Landes.
Acceptance	
Acceptance level of possible future implementation	Motorcycle associations are strongly against. The ministry of environment is concerned about the 1% of increase in CO_2 in the atmosphere due to more fuel consumption. Even the Direction pour la circulation et la sécurité routière is not sustaining this measure which has been proved to be highly effective in Les Landes on main rural roads.
Evaluation reports	C. Robert (2000). La question de l'allumage des feux de jour. Rapport pour le Ministre de l'équipement, des transports et du logement. Conseil Général des Ponts et Chaussées, Paris
National expertise	
Any other experts?	Jean Chapelon has conducted a consensus group on the subject, last year (jean.chapelon@equipement.gouv.fr).

Below follows a translation of the French summary of the most important conclusions concerning acceptance levels and possible implementation scenario's discussed in the extensive French evaluation report "The issue of daytime running lights" by Robert (2000).

Evaluation studies from other countries

With the notable exception of F.F.A.C. (see below), the organisations representing the consulted road users in France are not very convinced by the foreign evaluation studies (or by what they hear about them).

The DG VII (direction B) on its part has just brought a case before the new commissioner of Transport for a set of road safety measures containing a series of six priority measures and a series of five secondary measures. Daytime running lights are part of the second series. It is proposed to continue the preceding studies on two issues: the cost-benefit ratio and the estimation of the effect on pollution. This, while the competent officials of the DG VII actually continue to think that the European Union has legitimate reasons only to interfere in the equipment of vehicles and that the best solution would be, for *new* vehicles only, either to impose the automatic switching on of daytime running lights or to impose "an" automatic system leaving the member states the choice between the automaticity at starting the engine or the automaticity through the use of receptors (i.e., a "light sensitive on switch"). To all appearances, a decision is not to be expected soon.

The equipment of vehicles

1. When it is proved that the visibility should be improved by day, even in good weather conditions, the best solution seems to be the one where the vehicles are equipped with a device which switches on special daytime running lights automatically when the engine is started. This lighting device should be constructed in such a way that the visibility of other vehicles is improved without hindering the drivers. Moreover, this system has the following three advantages:
   - it does not hinder the most vulnerable road users (cyclists, pedestrians) while improving the visibility of cars and trucks (this should be verified of course).
   - it allows for the differentiation of motorcycles which could continue to ride with dipped headlights which could moreover be coloured lights.
   - it is easily combined with the installation of receptors which switch on the dipped headlights when the ambient light is reduced (and automatically switch off the daytime running lights).
2. When it is estimated that no serious problems arise during daytime with reduced visibility conditions (bad weather conditions, dawn, dusk), the use of receptors is a suitable solution, under the condition that this new technology is reliable. This equipment has a gold colour and is already proposed by certain manufacturers of top quality vehicles. Be this as it may, the automatic on switching of daytime running lights also contributes to solving the problem by harmonising the behaviour (of road users). These lights (which are by definition switched on all day long) will be even more conspicuous during times of reduced visibility.
3. These solutions concerning the equipment of vehicles serve the general purpose of not distracting the driver and of improving his concentration on the essential, which is driving.
4. The rules of vehicle equipment correspond to European standards.

The period of transition

Especially due to the costs involved, it is difficult to conceive how the installation of new electrical or electronic equipment could be imposed on all cars. Therefore, if DRL were implemented, the problem of a transition period will arise, required for the renewal of all cars. To deal with this period there are three possible options

- do nothing (at least not immediately, until 30% of all cars has been renewed for example),
- recommend the use of DRL,
- impose the use of DRL (after a period of adaptation).

The latter two solutions could be applied to all roads outside agglomerations.

If a technical measure is combined with a behavioural measure, the choice between recommendation and obligation is a difficult one. Recommendation has the main virtue of helping the adaptation of road users to the measure and has the connotation of an active sense of public responsibility. However, it also implies the mixing of vehicles using and not using DRL, which is considered dangerous by some experts, but not by others; it also makes the evaluation more difficult and less meaningful.
Obligation has the opposite characteristics: it makes the measure more general and its evaluation easier; however, it also poses a tremendous enforcement problem. Even after a long notification period, should the police fine the opponents and the forgetful? And what to do if there are many of them?
Clearly, if a behavioural measure should be considered, a massive communication campaign would have to be started and relaunched periodically. It is to be foreseen that this will raise objections from individuals.

Mixed traffic
The issue of mixing vehicles with and without lights must be considered carefully. Some experts (whose advice seems to be shared on this point with ophtalmologists) are afraid of a negative safety effect. However, experiences abroad do not seem to give evidence to this risk. It would be a good idea to make use of the current experiences (in Les Landes, the Netherlands, Austria) to elucidate this point.

If recommended or imposed, all roads or outside built-up areas?
The choice between a general measure and a measure limited to the areas outside agglomerations is not easy in France.
The general measure has the advantage of simplicity of implementation and enforcement but raises the justified fears of the vulnerable road users especially in agglomerations where there are many of them, while it is the only means to actually evaluate the real effects on these types of road users, a contradiction.
Limiting the measure to rural roads should partially reassure the vulnerable road users (pedestrians and urban cyclists) without mollifying, however, the hostility and fears of the motorcyclists and cyclists circulating on rural roads. One may also question whether such a partial solution is suitable for France with its geography characterized by very scattered cities and villages. It is to be foreseen that not many drivers will acquire the reflex to adapt their lights when seeing the road signs for entering and leaving agglomerations, and that there will be different reactions.

The impact of a recommendation or obligation on the current car stock
The current car stock has not been built for this task. Moreover, the experience in Les Landes has shown the risk of empty batteries (due to their running out) in vehicles not equipped with alarm systems (approximately half of the car stock).

The current acceptance levels of French institutes and organisations
With the notable exception of the F.F.A.C., whose president thinks it imperative to implement any measure whose positive effect on road safety is scientifically proven, the discussions with the parties involved does not give the feeling that daytime running lights are of primary importance. Neither the administrations (except for the police), nor the organizations seem to think it worth the effort; they have other priorities. Against this background, the fears

of the organizations representing the so-called vulnerable road users are strong and expressed with vehemence.
Supposing that the present report (i.e., by Robert) opens up discussions at the ministerial level, it should not be too difficult to obtain an agreement between the three Ministries of Equipment, of Internal Affairs, and of Defense concerning a national experiment. However, one should expect serious objections from the Ministry of Environment.
Schematically, positions of the different French organisations concerning the voluntary or compulsory use of dipped headlights during the day by the existing car stock can be arranged in the following three categories:

1. Very much in favour or rather in favour are:
   - Fédération Française des Automobile-Clubs (F.F.A.C.)
   - Fédération Française de Motocylisme (F.F.M.)
   - Syndicat des médicins ophtalmologistes (with reservations concerning motorists)

2. Very much opposed or rather opposed are:
   - Fédération Française des Motards en Colère (F.F.M.C.)
   - Fédération Nationale des Usagers des Transports (F.N.A.U.T.)
   - Fédération des Usagers de la Bicyclette (F.U.B.I.C.Y.)
   - Droits du piéton
   - France Nature Environnement

3. The following organisations have reservations:
   - Prévention routière
   - Constructeurs
   - Laboratory of Accidentology, Biomechanics and human behaviour (L.A.B.)
   - Fédération Française de Cyclotourisme (F.F.C.T.)
   - Consultant ophtalmologiste des Armées et des Transports
   - Association Nationale pour l'Amélioration de la Vue

The system of automatic DRL mentioned above, seems to have the potential of rallying the different organizations in favour of implementation, with the exception of the F.F.A.C. which raises the issue that the time lost in the decision and implementation process of this system is unacceptable.

App. 5.4 Germany

Legislation	
Are/were there any plans?	No.
Type of road users	NA
Types of roads	NA
Months of the year	NA
Type of light	General remark: this question shows that one must clearly define what is meant by "Daytime Running Lights" (i.e., whether automatically switched on, or manually).
DRL lights switched on automatically?	NA
Special type of light bulb for DRL?	NA
Voluntary use	
Current status on voluntary use?	An evaluation of the quantative numbers of voluntary users of DRL (dipped headlights) is not possible. There are indications that dimmed lights are also used with stronger environmental light, but until now there is no representative research on this subject. The obligation of using light for all vehicles is generally laid down in §17 of the German Road Traffic Regulations. According to article 2a of this law motorcycles must carry dipped headlights also during the day. All other vehicles have to use the light devices prescribed when the visibility conditions so require – especially during darkness and during dusk, but also when visibility is impaired by rain, snowfall or fog as well as by smoke or other comparable influences caused by human beings. Please note that no prohibition of the use of dipped headlights even during daytime can be derived from §17 of the German Road Traffic Regulations.
Acceptance	
Acceptance level of possible future implementation	Neither from the country (Länder) nor from the big car companies is there any pressure on the government to dedicate itself to the introduction of DRL. The general conviction seems to be that there is no actual significant benefit. Sometimes voices of citizens are heard asking for the reasons why there is no DRL in Germany, but as many citizens speak against such an obligation. (It should be noted here that motor vehicle users are free to carry lights also during the day, see the answer to the previous question.) The motorcyclists lobby has spoken against the introduction of DRL for all motorised vehicles. Until now the interest groups for more vulnerable road users have also not spoken in favour of the introduction of DRL.
Evaluation reports	No.
National expertise	
Any other experts?	This subject is coordinated with the appropriate bodies of the government through Report S 32.

App. 5.5 The Netherlands

Legislation	
Are/were there any plans?	Yes, there were plans.
Type of road users	Cars and motorcycles.
Types of roads	All roads.
Months of the year	The whole year.
Type of light	Dipped beam headlights or daytime running lamps.
DRL lights switched on automatically?	Automatically.
Special type of light bulb for DRL?	Not so far. In the future we would like to use energy-efficient (specific DRL) lamps, that work independently from rear, dashboard and number plate lighting.
Voluntary use	
Current status on voluntary use?	Voluntary use is about 50%; more outside than inside built-up areas; it varies with the weather conditions (less used in sunny weather).
Acceptance	
Acceptance level of possible future implementation	Public acceptance seems high (especially with motorists). There is strong opposition from organisations of pedestrians, cyclists and motor cyclists. They are afraid they will be relatively less conspicuous. There are also concerns about extra fuel consumption and CO_2 emission.
Evaluation reports	No.
National expertise	
Any other experts?	The SWOV Institute for Road Safety Research.

App. 5.6 Spain

Legislation	
Are/were there any plans?	In Spain, we are considering the convenience or not of using DRL. Nowadays it is exclusively compulsory in the case of motorcycles.
Type of road users	Our idea "totally provisional" would be applicable to all kind of vehicles.
Types of roads	If one day it would become compulsory, our intention would be to make it compulsory for all kind of roads, except built-up areas.
Months of the year	In principle it would be for all months of the year.
Type of light	Not studied.
DRL lights switched on automatically?	Not studied, because of the problems which could ensue from the fact of making it compulsory for some roads, and not for others.
Special type of light bulb for DRL?	Not studied.
Voluntary use	
Current status on voluntary use?	Yes, the voluntary use of DRL is increasingly frequent on roads outside built-up areas. It has also been used for a long time by members of our traffic police.
Acceptance	
Acceptance level of possible future implementation	There are no studies on this area. We think that it would not be extremely difficult to implement that measure, except for opposition from bike riders and, perhaps, ecologists.
Evaluation reports	Not studied the level of acceptance. There is a study on the measure in itself developed by the Center Zaragoza, Address: Crtra. Nacional 232, Km 273, 50690 Pedrola (Zaragoza).
National expertise	
Any other experts?	Executive Director Legislation and Complaints (DGT) Edificio General Aranaz 86 28027 Madrid (vhernando@dgt.es)

App. 5.7 Switzerland

Legislation	
Are/were there any plans?	Voluntary use of DRL introduced on January 1, 2002. It is a recommendation and is not compulsory, that means that non-compliance does not incur a fine. Link: http://www.lichtein.ch/.
Type of road users	Recommended for all motorized vehicles.
Types of roads	Not compulsory, they can be used on all roads.
Months of the year	Not compulsory, but recommended at all times.
Type of light	Dipped headlights.
DRL lights switched on automatically?	The DRL lights are not switched on automatically.
Special type of light bulb for DRL?	There is no special type of light bulb in use.
Introduction	
Media campaigns?	Introduction of voluntary use of DRL with a joint campaign (radio announcements before and after traffic information, posters nationwide, flyers, Internet, Infomedia) under bfu's supervision. http://www.test-luci.ch/ http://www.demarrerallumer.ch/
Penalties on not carrying DRL	No fines (see 1).
Police enforcement?	No police enforcement activities.
Voluntary use	
Current status on voluntary use?	
Acceptance	
Acceptance level of voluntary use before introduction	Prior to introduction, widescale support of the Swiss Federal Roads Authority, Swiss Insurance Association, automobile associations, automotive trade, public transport authorities, associations of driving school instructors, police, traffic authorities, Fonds für Verkehrssicherheit (Road Safety Fund), Schweizerischer Verkehrssicherheitsrat (Swiss Council for Road Safety). All were partners in the joint campaign. Acceptance by the public: In 1999, 21% of the Swiss population would tend to be in favour of compulsory Daytime Running Lights for cars (bfu survey, autumn 2002). In 2000, the proportion of those in favour was 38% and in 2001 56%.
Acceptance level of voluntary use after introduction	Opposition: Opposition to the measure was expressed by individuals in the form of letters to newspapers or in e-mails/letters to the bfu or other partners in the joint campaign. Acceptance by the public: 64% of the Swiss population would tend to be in favour of compulsory Daytime Running Lights for cars (bfu survey, autumn 2002).
Evaluation reports	No evaluation available. 9 to 25 percent increase in the use of DRL in fine weather. Link Infomedia 2.7.2002: http://www.bfu.ch/medien/infomedia/infomedia_2002/2114.htm
National expertise	
Any other experts?	None, apart from some of our partners.

App. 5.8 United Kingdom

Legislation	
Are/were there any plans?	No.
Type of road users	NA
Types of roads	NA
Months of the year	NA
Type of light	NA
DRL lights switched on automatically?	NA
Special type of light bulb for DRL?	NA
Voluntary use	
Current status on voluntary use?	Cars in GB that were manufactured in countries with mandatory use of DRL (mainly Volvos and Saabs) typically drive with DRL, because the lights come on automatically, but drivers of other vehicles only turn on in daytime in conditions of poor visibility.
Acceptance	
Acceptance level of possible future implementation	The issue of DRL has received virtually no public discussion in GB. There is some prejudice among the general public against Volvo drivers, who are sometimes perceived as aggressive, and this association may have created a slight hostility.
Evaluation reports	None that I am aware of.
National expertise	
Any other experts?	VSE Division of the UK Department for transport deals with vehicle lighting and other issues concerning vehicle standards and equipment, I do not know which official is currently responsible. TRL has carried out research into vehicle lighting for the Department of Transport, and when I carried out a review of the Koornstra report some years ago I consulted the one remaining person who had been involved. He had only limited knowledge, and has since retired.

App 5.9 United States of America

Here we discuss the situation in the United States, as we deduced from an email and documents concerning DRL that we received from the official responsible for the U.S. Federal Motor Vehicle Safety Standard (FMVSS) 108 at the National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation (NHTSA, 2002).

According to a document written by Bergkvist of General Motors (2001), the use of DRL in the US is not compulsory, but a final rule was published in January 1993 amending Federal Motor Vehicle Safety Standard (FMVSS) 108 to explicitly allow the *voluntary* installation of DRL. This rulemaking was needed because a multitude of conflicting state laws had the practical effect of prohibiting the installation of DRL.

General Motors began to install DRL on selected 1995 model year vehicles. By the 1997 model year, DRL were standard equipment on all General Motor vehicles sold in the U.S. To date, General Motors has sold more than 23 million vehicles in the U.S. equipped with DRL. General Motors, Saab, Volvo and Volkswagen were the first manufacturers to introduce DRL in the U.S.

Also according to Bergkvist, DRL are provided in a variety of configurations. These include reduced intensity upper beams, reduced or full intensity low beams, dedicated DRL, or turn signal DRL. A Notice of Proposed Rule Making (NPRM) was issued by the NHTSA in August 1998 intended to address glare. NHTSA explained that the proposal to limit DRL photometric output was prompted by numerous driver complaints regarding DRL glare. The National Highway Traffic Safety Administration (NHTSA) planned to address glare according to the following plan:

Phase 1 – DRL using the upper headlamp beam would not be permitted to exceed 3,000 cd at any point. Starting one year after publication of the final rule.

Phase 2 – Reduce the intensity to 3000 cd anywhere in the beam and for lower beam DRL to maximum 3000 above horizontal. Starting two years after publication of the final rule.

Phase 3 – Reduce the intensity to 1500 cd anywhere in the beam and for lower beam DRL to maximum 1500 cd above horizontal. Starting four years after publication of the final rule.

Again according to Bergkvist of General Motors (2001), an analysis of the complaints that NHTSA had received revealed that the number of complaints were overestimated because of repeats and multiple copies of letters. Some complaints were solicited by organizations who opposed DRL in principle. When the solicited and redundant comments were removed, the actual number of unsolicited complaints fell dramatically.

Also according to Bergkvist of General Motors, in Canada where DRL has been mandatory since 1989, the few initial DRL complaints dropped to virtually zero by the early 1990s. Canadian complaints continue to be virtually non-existent even though they have the same photometric provisions as those specified in the current U.S. FMVSS 108. This suggests that perceived glare may be a novelty effect. Accordingly, General Motors is hopeful that NHTSA does not adopt the DRL photometric restrictions proposed in the NPRM.

Finally, Bergkvist mentions that General Motors believes there is a strong general acceptance of DRL in the market. To support this he presents the results of surveys conducted to determine the consumers perception of DRL as a safety feature. In a survey conducted in 1997, it was found that 23% of the respondents definitely wanted DRL implemented as a safety feature of motor vehicles. In a second survey conducted in 1998, it was found that 64% of the respondents were of the opinion that DRL is a beneficial feature, 26% that it is a neutral feature, 8% that it is a negative feature, and 2% did not respond. However, nothing is mentioned about the sample sizes used in these two surveys.

According to the official who is responsible for the U.S. FMVSS 108 of the NHTSA, DRL appear to reduce crashes in the U.S., although a study that the NHTSA performed is not robust enough to use for deciding whether mandating DRL would be cost effective (NHTSA, 2000). The NHTSA are now revising that study with a few more years of data. The new study should be published in May 2003. Additionally, there is a General Motors sponsored study described in Bergkvist. It has the same small data sample problem. GM is also redoing the study with more recent data and the result should also be available in May 2003.
Again according to the official at NHTSA, one thing that is particularly important for public acceptance is to ensure that the DRL intensity is high enough to be conspicuous, but not so high as to be considered glaring. That is an issue that NHTSA is currently resolving based on hundreds of complaints from the public. Information about this may be read at: http://dms.dot.gov/search/searchFormSimple.cfm searching for 3319 and 4124 as the two docket numbers. As a result, NHTSA is about to publish an amendment to substantially reduce the permitted intensity. There will be an additional amendment to deal with further intensity reductions and some issues concerning wiring and use. This amendment will follow toward the end of this year. Also, General Motors, based on its study of the data, has formally petitioned NHTSA to amend the Standard to mandate the use of DRL. NHTSA has not made any decision yet on whether to act on that petition or not.

Attachment D

Senate Bill 1138, Michigan State Legislature, 2008,
http://www.legislature.mi.gov/(S(sapn303cev1ccufuvn2pjtip))/mileg.aspx?page=getObje ct&objectName=2008-SB-1138

SENATE BILL No. 1138

February 27, 2008, Introduced by Senator PRUSI and referred to the Committee on Transportation.

A bill to amend 1949 PA 300, entitled

"Michigan vehicle code,"

by amending section 684 (MCL 257.684).

THE PEOPLE OF THE STATE OF MICHIGAN ENACT:

Sec. 684. ~~(a) Every~~ **A** vehicle upon a highway within this state ~~at any time from a half hour after sunset to a half hour before sunrise and at any other time when there is not sufficient light to render clearly discernible persons and vehicles on the highway at a distance of 500 feet ahead~~ shall display lighted lamps and illuminating devices as ~~hereinafter respectively~~ required **UNDER THIS CHAPTER** for different classes of vehicles, subject to exceptions ~~with respect to~~ **FOR** parked vehicles as ~~hereinafter stated~~ **PROVIDED UNDER THIS CHAPTER.** ~~When lighted lamps and~~

SENATE BILL No. 1138

~~illuminated devices are required by law no~~ **A** vehicle shall **NOT** be operated upon ~~any~~ **A** highway of this state with only the parking lights illuminated on the front of the vehicle.

~~(b) Whenever requirement is hereinafter declared as to the distance from which certain lamps and devices shall render objects visible or within which such lamps or devices shall be visible, said provisions shall apply during the times stated in paragraph (a) of this section upon a straight, level, unlighted highway under normal atmospheric conditions unless a different time or condition is expressly stated.~~

~~(c) Whenever requirement is hereinafter declared as to the mounted height of lamps or devices, it shall mean from the center of such lamp or device to the level ground upon which the vehicle stands when such vehicle is without a load.~~

Attachment E

Joseph M. Tessmer, "An Assessment of the Crash-Reducing Effectiveness of Passenger Vehicle Daytime Running Lamps (DRLs)," U.S. Department of Transportation, National Highway Traffic Safety Administration, Mathematical Analysis Division, National Center for Statistics and Analysis, September 2004, *http://www-nrd.nhtsa.dot.gov/Pubs/809760.PDF*

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7. Author(s) Joseph M. Tessmer	8. Performing Organization Report No.
9. Performing Organization Name and Address Mathematical Analysis Division, National Center for Statistics and Analysis National Highway Traffic Safety Administration U.S. Department of Transportation NPO-121, 400 Seventh Street, S.W. Washington, D.C. 20590	10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Mathematical Analysis Division, National Center for Statistics and Analysis National Highway Traffic Safety Administration U.S. Department of Transportation NPO-121, 400 Seventh Street, S.W. Washington, D.C. 20590	13. Type of Report and Period Covered NHTSA Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes

Abstract

This study estimates the effectiveness of passenger vehicle daytime running lights in reducing two-vehicle opposite direction crashes, pedestrian/bicycle crashes, and motorcycle crashes. The authors chose the generalized simple odds, a conventional statistical technique, to analyze the data.

Results based on simple odds indicate that from 1995 to 2001:

- DRLs reduced opposite direction daytime fatal crashes by 5 percent.
- DRLs reduced opposite direction/angle daytime non-fatal crashes by 5 percent.
- DRLs reduced non-motorists, pedestrians and cyclists, daytime fatalities in single-vehicle crashes by 12 percent.
- DRLs reduced daytime opposite direction fatal crashes of a passenger vehicle with a motorcycle by 23 percent.

Reviewers of this paper required the inclusion of results using the odds ratio technique. The estimated the effect of DRLs are −6.3 percent, −7.9 percent, 3.8 percent, and 26 percent, respectively. None of these results were statistically significant.

17. Key Words	18. Distribution Statement
daytime running lamps, daytime running lights, DRL, DRLs, logistic regression, simple odds, fatal crashes, FARS, NASS, GES, motorcycle, pedestrians, cyclists	Document is available to the public through the National Technical Information Service, Springfield, VA 22161 http//:www.ntis.gov

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	36	

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TABLE OF CONTENTS

2917

List of Tables

Executive Summary

This study estimates the effectiveness of passenger vehicle daytime running lights in reducing two-vehicle opposite direction crashes, pedestrian/bicycle crashes, and motorcycle crashes. The authors chose the generalized simple odds, a conventional statistical technique, to analyze the data. The generalized odds ratio attempts to adjust for a variety of exogenous factors other than the presence or absence of DRLs not specifically controlled for within the model.

Significant results of this study show that from 1995 to 2001:

Simple Odds Results:

- DRLs reduced opposite direction daytime fatal crashes by 5 percent.
- DRLs reduced opposite direction/angle daytime non-fatal crashes by 5 percent.
- DRLs reduced non-motorists, pedestrians and cyclists, daytime fatalities in single-vehicle crashes by 12 percent.
- DRLs reduced daytime opposite direction fatal crashes of a passenger vehicle with a motorcycle by 23 percent.

The reviewers of this paper required the inclusion of an analysis based on odds ratio, which can be found in Appendix B. Like the simple odds, the odds ratio attempts to control for a variety of factors other than the presence or absence of DRLs. The estimated effectiveness of DRLs based on this technique is extremely sensitive to small changes encountered in real world crash data. As a result, reductions in target crashes during the daytime using the odds ratio technique may not be detected over the inherent background noise of the data system. **None** of the results based on the odds ratio are statistically significant.

Odds Ratio Results:

- DRLs reduced opposite direction daytime fatal crashes by –6.3 percent that is DRLs increase opposite direction daytime fatal crashes by 6.3 percent.
- DRLs reduced opposite direction/angle daytime non-fatal crashes by –7.9 percent that is DRLs increase opposite direction/angle daytime non-fatal crashes by 7.9 percent.
- DRLs reduced non-motorists, pedestrians and cyclists, daytime fatalities in single-vehicle crashes by 3.8 percent.
- DRLs reduced daytime opposite direction fatal crashes of a passenger vehicle with a motorcycle by 26 percent.

METHODOLOGY:

A case-control method was chosen as the approach for this study, since only specific make-models for each year were equipped with DRLs. The number of crashes for a set of passenger vehicles equipped with DRLs is compared to passenger vehicles manufactured in the same years without DRLs. The groups of vehicles are analyzed by time of day and crash type.

The generalized simple odds method was used to analyze the data. This technique implicitly attempts to control for factors, other than the presence or absence of DRLs, that could be associated with crash occurrences. The effectiveness of DRLs due to differences in passenger vehicle types, namely, passenger cars, SUVs, vans, and light/pickup trucks is addressed explicitly. The simple odds provided useful statistically significant results.

Background

This is the second NHTSA study on the effectiveness of Daytime Running Lamps (DRLs). The preliminary study was published in June 2000 and is the basis of this research.

Many traffic crashes are the result of the failure of a driver to notice another vehicle. Visual contrast is an essential characteristic that enables a driver to detect vehicles. The purpose of daytime running lamps (DRLs) is to increase the drivers' ability to detect DRL-equipped vehicles, particularly in the peripheral visual field, by increasing visual contrast. Seven countries require the use of DRLs during all daytime periods: Canada, Denmark, Finland, Hungary, Iceland, Norway, and Sweden. Results of DRL studies from these countries consistently, however not conclusively, show that DRLs reduce the number of two-vehicle crashes during daylight, dusk, and dawn. This study examines the effectiveness of first-generation DRLs, using U.S. national data for passenger vehicles.

DRLs come in a variety of configurations. DRLs may be upper beam headlamps at reduced intensity, low-beam headlamps at full or reduced power, turn signals or dedicated lamps. In addition the brightness, color and light dispersion are design features of DRLs. Four manufacturers began equipping selected 1995 model year vehicles, for sale within the U.S., with DRLs. General Motors Corporation produces DRL-equipped vehicles with higher intensity DRLs than those used in Scandinavian countries. In the U.S. the availability of DRL-equipped vehicles has increased with each model year since 1995. Since the cost of DRLs is low, small reductions in the number of crashes would likely be considered cost effective. A partial chronological summary of results from several previous studies of the effectiveness of DRLs follows.

Finland's legislation of 1972 required the use of low-beam headlights in rural areas during winter. The rural multiple-vehicle daytime crash rate decreased by 27 percent as a result.[1]
In 1975, Clayton and Mackay[2], at Indiana University, found that drivers failing to process information properly caused almost half of all crashes. The most prevalent information processing errors were faulty visual perception, recognition errors and comprehension errors. In addition, it was shown that traffic crashes were due more to inattention and distraction than to poor vision. The crash reduction potential of DRLs lies in their ability to attract attention, especially in the peripheral visual field, thereby enhancing detect ability.

A study conducted by Transport Canada[3] in 1975-1976 examined the crash experience with part of the Canadian defense vehicle fleet equipped with automatic headlights, a version of DRLs. The results

[1]Andersson, K., Kilsson, G., and Salusjärvi, S. The Effect On Traffic Accidents on the Recommended use of Vehicle Running Lights in the Daytime in Finland. Report No 102. Swedish road and Traffic Research Institute (VTI), 1976.

[2]Claton, A.B. and Mackay, G.M. Aetiology of Traffic Accidents. Health Bulletin, 31(4), 277-280, 1972.

[3]Attwood, D.A. The Potential of Daytime Running Lights as a Vehicle Collision Countermeasure. SAE Technical Paper 810190. Society of Automotive Engineers, 1981.

published by Attwood in 1981 showed a 20 percent crash decrease in the specially equipped vehicles compared to the comparison group of unmodified vehicles.

Swedish legislation required the use of DRLs throughout the year starting in October 1977. An 11 percent reduction in daytime crashes was observed. Two-vehicle, head-on crashes were reduced by 10 percent, angle crashes were reduced 9 percent, crashes involving a bicycle or moped were reduced by 21 percent, and crashes involving a pedestrian or a cyclist decreased 17 percent.[4] These results were questioned by Theeuwes and Riemersma in 1995[5], as the proportion of multi-party crashes was not reduced as a proportion of all crashes.

Hills, in 1980[6], and more recently Sekuler and Blake,[7] found that increasing the visual contrast of a vehicle increases the ability of other drivers to detect and monitor the vehicle. Low contrast between a vehicle and its background can be quite common during daylight hours. Contrast is reduced by color, rain, clouds and low levels of light that occur at dawn and dusk.

Stein reported in 1985[8] the results of a study by the Insurance Institute for Highway Safety (IIHS), which equipped over 2,000 passenger cars, light trucks and vans with DRLs. Relevant multi-vehicle crashes were 7 percent lower for the DRL-equipped vehicles than the comparison (unmodified) vehicles.

Norway required the installation of DRLs by vehicle manufacturers in January of 1985 and the use of low beam head lights was required on all vehicles in Norway not equipped with DRLs in April of 1988. Elvik reported[9] that a 15 percent reduction in all summertime multi-vehicle daylight crashes was achieved.

Canada required that all new passenger cars, trucks, multi-purpose vehicles, and buses manufactured for sale in Canada be equipped with DRLs after December 1, 1989. In September 1993 Arora, et al.[10]

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[4]Andersson, K. Nilsson, G. The Effects on Accidents of Compulsory Use of Running Lights During Daylight in Sweden. Report No. 208A, Swedish Road and Traffic Research Institute (VRI),1981.

[5]Theeuwes, J. and Riemersma, J. Daytime Running Lights as a Vehicle Collision Countermeasure: The Swedish Evidence Reconsidered. Accident. Anal. Prevention. 27:633-642, 1995.

[6]Hills, B.L. Vision, Visibility and Perception in Driving. Perception, 9, 183-216, 1980.

[7]Sekuler, R. and Blake, R. Perception, (Second Edition) Toronto: McGraw-Hill, 1990.

[8]Stein, H. Fleet Experience with Daytime Running Lights in the United States. SAE Technical Paper 851239. Warrendale, PA, Society of Automotive Engineers, 1985.

[9]Elvik, R. The Effects of Accidents of Compulsory Use of Daytime Running Lights for Cars in Norway. Accident Analysis and Prevention, 25(4) 383-398, 1993.

[10]Arora, H. Collard, D. Robbins, G. Welbourne, E.R. White, J.G. Effectiveness of Daytime Running Lights in Canada, Report No. TP1298 (E). Transport Canada 1994.

conducted an extensive analysis on the effectiveness of DRLs for Transport Canada. They estimate that relevant crashes were reduced by 11.3 percent, which was statistically significant at $p<0.05$.

In October of 1990, Denmark required universal use of DRLs. No overall effect was reported. However, Hansen identified a statistically significant 37 percent decrease in crashes involving a left turn in 1993[11].

Hungary has required the use of DRLs on rural roads since March 1993. Hollo studied the crash experience of DRL-equipped vehicles and presented the findings at a conference in the Czech Republic in 1995[12]. Several changes in traffic regulations and enforcement, which includes the reduction of the speed limit, stricter seat belt laws, increases in police patrols, significantly higher fines and a campaign to increase public awareness of traffic-related issues were considered confounding factors, thereby making it difficult to estimate the effect of DRLs. Nonetheless, Hollo estimates that DRLs reduced the number of rural daytime "frontal and cross traffic" crashes by 7 to 8 percent. Hallo further claims that during "good visibility" crashes are reduced 11 to 14 percent.

IIHS' Highway Loss Data Institute (HLDI) in 1997[13] released findings from a study of the personal injury claims for vehicles that added DRLs as a standard feature in 1995 and 1996, compared to the claim frequencies for the same makes and models prior to adding DRL. The number of relative claims was found to have increased slightly after DRLs were introduced. However, HLDI's study was not able to identify a consistent pattern of increases among vehicles. HLDI's study hypothesized that this finding was not surprising, as "...claims for striking vehicles, single-vehicle crashes, and nighttime crashes could not be identified..." and therefore, could not be excluded from the study. Striking vehicle, single-vehicle, and nighttime crashes would not likely be impacted by the presence of DRLs.

Tofflemire and Whitehead[14] re-analyzed the Canadian DRL law in 1997 using a "quasi-experimental comparative posttest design" and found that opposite direction and angle crashes were reduced by 5.3 percent, which was statistically significant at $p<0.05$. The study concluded that the DRL law had a greater effect on opposite direction crashes (15 percent reduction) than angle crashes (2.5 percent reduction).

Each province in Canada was individually analyzed. Only Nova Scotia and New Brunswick

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[11]Hansen, L.K. Daytime Running Lights in Denmark - Evaluation of the Safety Effect. Translated exact.

[12]Hollo, P. Changes of the DRL-Regulations and their Effects on Traffic Safety in Hungary. Paper presented at the conference: Strategic Highway Safety Program and Traffic Safety, the Czech Republic, September 20-22, 1995. Preprint for sessions on September 21, 1995.

[13]Highway Loss Data Institute Bulletin Volume 15, Number 1, December 1997.

[14]Tofflemire, T. C., Whitehead, P.C. An Evaluation of the Impact of Daytime Running Lights on Traffic Safety in Canada, Journal of Safety Research, Volume 28, Number 4, 1997.

experienced a statistically significant ($p<0.05$) reduction in crashes.

While the 1993 and 1997 Canadian studies described above are among the few studies reporting statistically significant results, in most other studies the data sets are small, which can result in nonsignificant statistical results, even when an effect might exist.

Hollo[15] reported that DRLs reduced daylight frontal and crossing vehicle crashes by 4.7 percent to 15.2 percent in Hungary, depending on the statistical technique used and assumptions made.

Tessmer[16] estimated that the effectiveness of DRLs in US fatal two-vehicle opposite-direction crashes ranged from –8 percent to 2 percent. For non-fatal crashes the effectiveness ranged from 5 percent to 7 percent. For pedestrians fatalities in single-vehicle crashes, the estimated effectiveness ranged from 28 percent to 29 percent.

Lau[17] estimates that DRLs reduce multiple vehicle crashes by 5 to 13 percent. Lau even estimates that DRLs reduce multiple vehicle nighttime crashes by 5 percent, which suggests that there may a confounding lurking variable within the data.

Farmer and Williams[18] demonstrated that DRLs are associated with a 3.2 percent decline in multiple-vehicle daylight crashes.

Thompson[19] in 2003 presented a paper at the April SAE meeting in Washington, DC. He estimated that DRLs reduced multiple vehicle collisions by 2.3 percent to 12.4 percent, depending on DRL type.

Table 1 summarizes findings from studies of the effectiveness of DRLs in several countries, including the U.S. The individual studies are identified by year, investigator(s), the type of study, i.e., did the study analyze the effects of DRLs on a specific fleet of vehicles, a case controlled study, or the result of a change in the law, applicable country, and the estimated effects of DRLs.

Table 1
Summary of Findings on DRL Effectiveness*

[15] Hollo, P., Changes in the Legislation on the Use of Daytime Running Lights by Motor Vehicles and Their Effect on Road Safety in Hungary, Accid. Anal. And Prev., Volume 30, No.2, pp 183-199, 1998.

[16] Tessmer, J.M., A Preliminary Assessment of the Crash-Reducing Effectiveness of Passenger Car Daytime Running Lamps (DRLs) ; DOT HS 808 645, June 2000.

[17] Lau, E. Daytime Running Light Effectiveness A Preliminary Evaluation, Presented at a Government/Industry Meeting, June 19-21, 2000 Washington, DC.

[18] Farmer, C.M. and Williams, A.F. Effects of daytime running lights on multiple-vehicle daylight crashes in the United States; Accid. Anal. And Prev., Volume 34, pp 197-203, 2002.

[19] Thompson, P.A., Daytime Running Lamps (DRLs) for Pedestrian Protection SAE Paper 2003-0102072, April 2003.

2924

Year	Investigator(s)	Study Type	Country	Estimated Effects
1972	Anderson et al[1]	Law	Finland	27% reduction rural multi-vehicle
1975	Attwood[3]	Fleet	Canada	20% some defense vehicles
1977	Anderson et al[4]	Law	Sweden	9% to 21% crash type dependent
1985	Stein[8]	Fleet	U.S.	7% reduction selected vehicles
1988	Elvik[9]	Law	Norway	15% reduction summer multi-vehicle
1993	Arora et al[10]	Law	Canada	11.3% reduction 2-vehicle opposite-direction
1993	Hansen[11]	Law	Denmark	up to 37% reduction - crash type dependent
1995	Hollo[12]	Law	Hungary	7% to 14% reduction frontal cross traffic
1997	Tofflemire et al[14]	Law	Canada	5.3% reduction opposite direction/angle crashes
1998	Hollo[15]	Law	Hungary	4.7% to 15.2% reduction frontal cross traffic
2000	Tessmer[16]	CC	U.S.	-8% to 29% crash type dependent
2000	Lau[17]	CC	U. S.	5% to 13% reduction multiple vehicle crashes
2002	Farmer et al[18]	CC	U.S.	3.2% decline in mult. vehicle daylight crashes
2003	Thompson[19]	CC	U.S.	2.3% to 12.4% DRL type dependent

* See Bibliography for detailed information on published studies.

Several factors could influence the effectiveness of DRLs, e.g., geography and the climate, the mix of rural and urban crashes, traffic conditions, and manner of collision. The approach of this study attempts to limit the influence of such exogenous variables by using comparison groups where the effects should be similar. This study examines the effectiveness of DRLs in the U.S. for vehicles of model years 1995 and later. Two sources of data maintained by the National Highway Safety Traffic Administration (NHTSA) are used to study DRL effectiveness: the Fatality Analysis Reporting System (FARS) and the National Automotive Sampling System/ General Estimates System (NASS/GES).

Methodological Changes from Preliminary Assessment

This study is the second study conducted by NHTSA to determine the effectiveness of Daytime Running Lamps (DRLs). The same basic statistical techniques to evaluate DRLs have been used. However, with the collection of additional data and the knowledge gained from NHTSA's first study, A Preliminary Assessment of the Crash-Reducing Effectiveness of Passenger Car Daytime Running Lamps (DRLs), which appeared in 2000, several improvements have been made. A great deal was learned about using national traffic crash data to analyze DRLs, which guided our efforts in the current study.

In the original study two comparison groups of fatal crashes were used, single vehicle fatal crashes and 2-vehicle same direction fatal crashes. There are many more single vehicle fatal crashes than 2-vehicle same direction fatal crashes. The results of the analysis based on using the 2-vehicle same direction fatal crashes do not produce sufficient power to reject the null hypothesis. Critics of the earlier study pointed out that in same direction crashes, a potential striking vehicle with DRLs could have the DRLs detected in the rear view mirror of the potentially stuck vehicle, which could then take corrective action. They argue that same direction crashes are not independent of DRLs and using them, as a comparison group would skew the results. For these two reasons, analysis using 2-vehicle same direction fatal comparison crashes has been eliminated from this study.

In the original study, both the simple odds, $O = TD/(CD+TN+CN)$[20], and the odds ratio, ? $= (TD/CD)/(TN/CN)$[1], were used in the analysis. The standard error of the odds ratio is much larger than the standard error of the simple odds. To be statistically precise, when using the simple odds, the null hypothesis can be marginally rejected, however, the power of the odds ratio is not sufficient to reject the null hypothesis. Therefore the analysis in the main body of this report was based solely on the simple odds. Several reviewers of the report required publication of the non-statistically significant results, based on the odds ratio. The results based on the odds ratio can be found in Appendix B of this report. Generalized forms of the simple odds and the odds ratio were also used in this study; see the appendices. A generalized form of the ratios allows one to adjust for a variety of identifiable factors such as vehicle type.

Target vehicles with DRLs and the comparison vehicles without DRLs have been partitioned in a different way. In the original study two groups of comparison passenger cars were used. The groups of target and comparison vehicles were identified by make and model. The original study's first comparison group consisted of vehicles of the same make and model prior to the adoption of DRLs. Vehicles in this comparison group were from 1 to 6 years older than the target vehicles equipped with DRLs. To eliminate the potential bias due to age in the original study a second group of comparison vehicles was selected, namely vehicles manufactured by the Ford Motor Company at the same time that the target vehicles were manufactured.

In the current study, the vehicles under analysis have been expanded from passenger cars to passenger vehicles. Both the target and comparison vehicles have been identified by analysis of the vehicle identification number (VIN). Target and comparison vehicles were all manufactured during the same time period. All passenger vehicles that could be classified as having DRLs as standard equipment were classified as target vehicles. All passenger vehicles that did not have DRLs as standard equipment nor as a standard option were included as comparison vehicles.

The effectiveness of DRLs in preventing fatal two-vehicle daytime opposite direction crashes of passenger vehicles with motorcycles was examined.

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20 See Appendix A, Page 19 for additional details on the simple odds and odds ratios.

2926

Four states, Florida, Maryland, Missouri and Pennsylvania were used to examine the effectiveness of DRLs for non-fatal crashes in the original study. However, one cannot extrapolate the effectiveness of DRLs to the nation. To obtain a national estimate, data from the General Estimates System (GES) was used. Since GES is a survey and not a census of crashes, software for the statistical analysis of correlated data, SUDAAN, was used to obtain credible estimates of statistical significance.

Finally a meta-analysis was used in the original study to attempt to provide an overall estimate of DRL effectiveness. This has been eliminated from the current analysis since the survey data was used to estimate the effects of DRLs for non-fatal crashes. The mixture of survey data and census data in a meta-analysis does not provide reliable results.

Data and Methodology

Previous studies of DRL effectiveness often have used a before vs. after approach. This approach is appropriate, for example, when a law goes into effect at a given point in time and one wishes to determine the effect of that law on traffic crashes. A case-control method was chosen as the approach for this study, since only specific make-models for each year were equipped with DRLs. A case-control method attempts to control for factors, other than the presence or absence of DRLs that could be associated with crash occurrence. In this study, the number of crashes for a fleet of vehicles equipped with DRLs is compared to a fleet of vehicles without DRLs produced in the same years. Both groups of vehicles are analyzed by time of day and crash type. Analysis of the Vehicle Identification Number (VIN) was used to partition passenger cars, vans, pickups/light trucks, and sport utility vehicles (SUVs) into a fleet of vehicles that did and did not have DRLs. Passenger vehicles that permitted DRLs as a standard option were removed from the analysis, since one could not analyze the VIN to determine if the specific vehicle was or was not equipped with DRLs.

Data from FARS[21] for calendar years 1995 - 2001 were used to examine DRL effectiveness for fatal two-vehicle opposite-direction crashes and for single-vehicle pedestrian/cyclist crashes. NASS/GES[22] data for calendar years 1995 – 2001 were used to examine DRL effectiveness for non-fatal two-vehicle opposite-direction crashes.

The analysis focused on the possible effect of DRLs in reducing crashes during daylight or twilight hours, as opposed to nighttime hours, when traditional lighting would be in use by all drivers. Therefore, the

[21] Fatal crash data are from NHTSA's *Fatality Analysis Reporting System (FARS)*. FARS contains data on a census of fatal traffic crashes within the United States and Puerto Rico. A crash must involve a motor vehicle traveling on a public roadway and must result in the death of an occupant of a vehicle or a non-motorist within 30 days of the crash to be included in FARS.

[22] Non-fatal crash data are from NHTSA's *National Automotive Sampling System/General Estimates System (NASS/GES)*. NASS/GES contains data from a survey of approximately 55,000 weighted traffic crashes across the United States. Both injury crashes and property damage only crashes are included.

target time period is daytime, including dawn and dusk, and the comparison time period is night23.

Target crashes and comparison crashes are defined by the crash configuration. Ideally, the only difference between daytime target crashes and daytime comparison crashes is that the set of daytime target crashes consists of crashes that could be affected by DRLs, while the set of daytime comparison crashes consists of crashes that would not be affected by DRLs. A target crash is a crash where the DRLs can be seen by the driver of the other crash involved vehicle. A comparison crash is a crash involving a single vehicle, where the visibility of DRLs is not relevant.

Neither the FARS nor the NASS/GES databases have a variable that partitions the data exactly into target and comparison crashes. Both data sets have variables, which permit one to approximate the desired partition. Therefore, it is possible that the partition of target crashes and comparison crashes may not be perfect. For example, the geometry of an angle crash might prevent a driver from seeing the DRLs of the other vehicle. If angle crashes that cannot be affected by DRLs are included in the set of target crashes, the estimated effect of DRLs, using FARS may be underestimated. Since the effectiveness is expected to be small, fatal target crashes have been limited to head-on crashes and sideswipe opposite direction crashes. Although the glare from DRLs may contribute to a single vehicle crash, this is unlikely. However, the data do not have the fidelity to identify such crashes. At night, one assumes neither the target crashes nor the comparison crashes should be affected by DRLs. This assumption, like all assumptions can be challenged. For example, if a driver of a DRL-equipped vehicle does not turn on his head/tail lights at night a crash may result. Again this unlikely set of events is within the realm of possibility; however, the available data do not permit one to identify or analyze such crashes. Two-vehicle target crashes were further distinguished, for the purposes of this study, by focusing on those involving crashes in which the two vehicles were traveling in opposite-directions.

The FARS and NASS/GES target crashes include head-on and sideswipe opposite direction crashes[24]. The set of single-vehicle crashes is used as a set of comparison crashes. The comparison groups of crashes, ideally, would represent those crashes, which would not be affected by the presence or absence of DRLs. In the case of nighttime crashes, it has been pointed out that the use of DRLs may cause headlamps to burn out more frequently, contributing to an increase in nighttime crashes. However, only early Volkswagen and Volvo vehicles use full intensity lower beam headlamps for DRLs. In addition, all vehicles equipped with DRLs are relatively new, model year 1995 and later, so the potential problem of burned out headlamps should be minimal. Hauer (1995) pointed out that single-vehicle crashes might also be affected by DRLs. Namely, two-vehicles on a collision course may detect each other earlier due to DRLs. In such a situation, a multi-vehicle crash may be avoided and a single-

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[23] An alternative partition of the light condition would be to exclude all dawn and dusk crashes from the analysis. A preliminary analysis to calculate the point estimate of DRL effectiveness during dawn and dusk was made. The result showed a larger value of DRL effectiveness during dawn and dusk than during the day. However, due to the limited number of dawn and dusk crashes, the result was not statistically significant.

[24] Sideswipe opposite direction crashes are two-vehicle crashes with the vehicles moving in opposite directions. The initial engagement does not overlap the corner of either vehicle by more than four inches, so that there is no significant involvement of the front or rear surface areas. In addition, there is no pocketing of the impact in the suspension areas. The impact swipes along the surface of the vehicles parallel to the direction of travel. There is low retardation of the force along the surface of the vehicles.

vehicle crash may result. Thus, the two comparison groups, nighttime crashes and single-vehicle crashes may not be statistically independent of DRLs, a required theoretical assumption for the analysis performed here. However, from a practical point of view, these two groups are as statistically independent from the target as is reasonably possible. That is, in general, a two-vehicle opposite-direction crash does not cause, nor does it prevent, a single vehicle crash. Likewise, a single-vehicle crash does not cause, nor does it prevent, a two-vehicle crash.

Two-vehicle crashes involving the rear end of one or more vehicles and sideswipe same-direction crashes have been eliminated from the study. Two-vehicle rear-end and sideswipe same-direction crashes might be meaningful choices for comparison crashes because they share similar vision-related causal factors as the target crashes, even though DRLs could play a role as a countermeasure in rear end crashes. One problem is that the number of such crashes is much smaller than single vehicle crashes and the results would not have enough power to reject the null hypothesis. However, there is another argument that although rear-end and same-direction sideswipe crashes are not the intended target of DRLs, they are relevant since they draw attention to following vehicles – particularly tailgating vehicles – where drivers may respond with actions that potentially can increase or decrease the risk of a crash. If this is the case, design issues of location, brightness and color may be relevant.

Crashes of three or more vehicles were eliminated from the analysis. The crash geometry can become quite complex and vague for crashes of three or more vehicles and the number of such crashes is small. It is easy to misclassify such a crash. Therefore, to reduce the possibility of contamination of the analysis, all crashes involving three or more vehicles have been eliminated.

Another possible source of contamination, albeit a small one, is crashes involving parked vehicles in a fatal crash. To insure a vehicle involved in the crash was not parked, the requirement that a driver was present or that the driver had left the scene, was imposed.

The vehicles in the analysis were restricted to passenger vehicles of model year 1995 and later. Passenger vehicles include passenger cars, SUVs, light tucks, and vans. The target group of vehicles with daytime running lamps and the comparison group of vehicles without daytime running lamps were identified by analysis of the Vehicle Identification Number, VIN. Analysis of the VIN partitioned vehicles into 4 distinct groups: 1) vehicles that had DRLs as standard equipment, 2) vehicles that did not have DRLs as standard equipment nor as a standard option,
3) vehicles that have DRLs as a standard option, and 4) other vehicles including vehicles where the VIN was not reported or could not be decoded.

The target group of vehicles was the group of vehicles with DRLs as standard equipment. The comparison group of vehicles was the group of vehicles without DRLs, which did not have DRLs as a standard option. Vehicles with DRLs as a standard option and the vehicles in the "other" category were eliminated from the analysis.

Caveats

To analyze the effect of a new vehicle safety device one needs to compare it to vehicles that do not have the device and in situations that should and should not be affected by the device. One attempts to assure that the respective partition of vehicles and crashes eliminates any lurking variables, but this can never be fully guaranteed. The selection and partition of vehicles and crashes were based on the analytic judgment.

DRL Effectiveness in Fatal Two-Vehicle Crashes

The target crashes are two-vehicle crashes where the vehicles are traveling in opposite-directions. The target crashes include head-on, and sideswipe opposite direction crashes. Single-vehicle crashes are the comparison crashes.

Table 2 shows the cross tabulation of the target and single-vehicle crashes under daytime and nighttime conditions for vehicles equipped with DRLs.

Table 2
DRL-Equipped Vehicles in Target and
Single-Vehicle Fatal Crashes, FARS 1995-2001

Time of Day	Target Crashes	Single-Vehicle Crashes	Total
Daytime	2,117	3,360	5,477
Nighttime	1,047	4,573	5,620
Total	3,164	7,933	11,097
Source: NHTSA, NCSA, FARS			

Table 3 shows the cross tabulation of the target and single-vehicle crashes under daytime and nighttime conditions for the comparison group of vehicles without DRLs.

Table 3
Vehicles w/o DRL in Target and Single-Vehicle Fatal Crashes, FARS 1995-2001

Time of Day	Target Crashes	Single-Vehicle Crashes	Total
Daytime	6,699	10,058	16,757
Nighttime	3,450	13,413	16,863
Total	10,149	23,471	33,620
Source: NHTSA, NCSA, FARS			

DRL Effectiveness in Fatal Two-Vehicle Crashes - Results

The effectiveness, based on the simple odds, of DRLs in preventing two-vehicle opposite direction fatal crashes during daylight is estimated to be **5.3** percent with ($p = 0.052$).

Passenger vehicle type may influence the effectiveness of DRLs. To examine this issue, vehicle types were included in the logistic fit of the data. The results are similar. The effectiveness, based on the simple odds, of DRLs in preventing two-vehicle opposite direction crashes during daylight is estimated to be **5.1** percent with ($p = 0.061$) when adjusting for vehicle type.

DRL Effectiveness in Non-Fatal Two-Vehicle Crashes

The target crashes are two-vehicle crashes where the vehicles are traveling in opposite-directions. Single-vehicle crashes are the comparison crashes.

Table 4 shows the cross tabulation of the target and single-vehicle non-fatal crashes under daytime and nighttime conditions for vehicles equipped with DRLs. Since NASS/GES is a complex sample survey a program such as SUDAAN must be used to estimate the level of significance of the parameters.

Table 4
DRL-Equipped Vehicles in Target and
Single-Vehicle Non-Fatal Crashes, NASS/GES 1995-2001

Time of Day	Target Crashes	Single-Vehicle Crashes	Total
Daytime	972,000	248,000	1,220,000
Nighttime	215,000	216,000	432,000
Total[25]	1,188,000	464,000	1,652,000
Source: NHTSA, NCSA, NASS/GES			

Table 5 shows the cross tabulation of the target and single-vehicle non-fatal crashes under daytime and nighttime conditions for the comparison group of vehicles without DRLs.

Table 5
Vehicles w/o DRL in Target and
Single-Vehicle Non-Fatal Crashes, NASS/GES 1995-2001

Time of Day	Target Crashes	Single-Vehicle Crashes	Total
Daytime	3,074,000	737,000	3,812,000
Nighttime	695,000	608,000	1,303,000
Total[24]	3,770,000	1,345,000	5,115,000
Source: NHTSA, NCSA, NASS/GES			

DRL Effectiveness in Non-Fatal Two-Vehicle Crashes - Results

The effectiveness, based on the simple odds, of DRLs in preventing two-vehicle opposite direction non-fatal crashes during daylight is estimated to be **5.2** percent with ($p = 0.075$).

Passenger vehicle type may influence the effectiveness of DRLs. To examine this issue, vehicle types were included in the logistic fit of the data. The results are similar. The effectiveness of DRLs in preventing two-vehicle opposite direction non-fatal crashes during daylight is estimated to be **4.4** percent with ($p = 0.133$) when adjusting for vehicle type. Since the value of p is greater than 0.1, the null hypothesis cannot be rejected. However, since this estimate of effectiveness is similar to the significantly significant value calculated without adjusting for vehicle type, with ($p = 0.075$) one could interpret this estimate as a weak confirmation of the previous result.

[25] Totals may not add due to rounding.

DRL Effectiveness in Fatal Single-Vehicle Pedestrian/Cyclist Crashes

As daytime running lamps reduce two-vehicle opposite-direction crashes, daytime running lamps may also reduce single-vehicle crashes with pedestrians or cyclists. To answer that question, one can modify the approach used above. FARS, 1995 to 2001, can again be used for this analysis. However, the analysis is performed at the person level, rather than the vehicle level[26]. The target group of persons is fatally injured pedestrians and cyclists in single vehicle crashes; the comparison group of persons is fatally injured occupants in single vehicle crashes. The target time period is daytime, including dawn and dusk and the comparison time period is night. The results follow:

Table 6
Single-vehicle Pedestrian and Cyclist Fatalities FARS 1995-2001
Vehicles Equipped with DRLs

Time of Day	Pedestrian and Cyclist Deaths	Occupant Deaths	Total
Daytime	710	6,288	6,998
Nighttime	1,153	8,136	9,289
Total	1,863	14,424	16,287
Source: NHTSA, NCSA, FARS			

Table 7
Single-vehicle Pedestrian and Cyclist Fatalities FARS 1995-2001
Vehicles Not Equipped with DRLs

Time of Day	Pedestrian and Cyclist Deaths	Occupant Deaths	Total
Daytime	2,515	19,540	22,055
Nighttime	3,876	24,946	28,822
Total	6,391	44,486	50,877
Source: NHTSA, NCSA, FARS			

[26] It is possible for a pedestrian fatality and an occupant fatality to occur in the same crash. In this case, both the pedestrian and cyclist death cell and occupant death cell are incremented. To avoid potential single vehicle crashes involving a pedestrian/cyclist death and an occupant death from confounding the data, this analysis is performed at the person level, not the crash level.

DRL Effectiveness in Fatal Single-Vehicle Pedestrian/Cyclist Crashes - Results

The effectiveness, based on the simple odds, of DRLs in preventing single-vehicle pedestrian/cyclist fatalities during daylight is estimated to be **12.4** percent with (p = 0.002).

Passenger vehicle type may influence the effectiveness of DRLs. To examine this issue, vehicle types were included in the logistic fit of the data. The results are similar. The effectiveness, based on the simple odds, of DRLs in preventing single-vehicle pedestrian/cyclist fatal crashes during daylight is estimated to be **12.9** percent with (p = 0.002) when adjusting for vehicle type.

DRL Effectiveness in Fatal Crashes of a Passenger Vehicle with a Motorcycle

Target crashes are two-vehicle opposite direction crashes between a passenger vehicle and a motorcycle. Comparison crashes are single vehicle crashes. In the analysis that follows, the DRL status of the passenger vehicle involved in a two-vehicle crash with a motorcycle determined if the crash was a DRL equipped crash or a non-DRL equipped crash.

Table 8 shows the cross tabulation of the target and single passenger vehicle crashes under daytime and nighttime conditions for passenger vehicles equipped with DRLs.

Table 8
Passenger Vehicles with DRLs Involved in Fatal 2-Vehicle Crashes of a Motorcycle and a Single Passenger Vehicle, FARS 1995-2001

Time of Day	Target 2-Vehicle Motorcycle Crashes	Single Passenger Vehicle Crashes	Total
Daytime	62	3,360	3,422
Nighttime	30	4,573	4,603
Total	92	7,933	8,025
Source: NHTSA, NCSA, FARS			

Table 9 shows the cross tabulation of the target and single passenger vehicle crashes under daytime and nighttime conditions for the comparison group of passenger vehicles without DRLs.

Table 9
Passenger Vehicles w/o DRLs Involved in Fatal 2-Vehicle Crashes of a Motorcycle and a Single Passenger Vehicle, FARS 1995-2001

Time of Day	Target 2-Vehicle Motorcycle Crashes	Single Passenger Vehicle Crashes	Total
Daytime	239	10,058	10,297
Nighttime	86	13,413	13,499
Total	325	23,471	23,796
Source: NHTSA, NCSA, FARS			

DRL Effectiveness in Fatal Crashes of a Passenger Vehicle with a Motorcycle - Results

The effectiveness, based on the simple odds, of DRLs in preventing two-vehicle opposite direction crashes between a passenger vehicle and a motorcycle during daylight is estimated to be **23.2** percent with ($p = 0.065$).

Passenger vehicle type may influence the effectiveness of DRLs. To examine this issue, vehicle types were included in the logistic fit of the data. The results are similar. The effectiveness, based on the simple odds, of DRLs in preventing two-vehicle opposite direction crashes between a passenger vehicle and a motorcycle during daylight is estimated to be **22.6** percent with ($p = 0.074$) when adjusting for vehicle type.

Conclusions

The effectiveness of daytime running lamps, based on the simple odds, was analyzed in the preceding sections using data from FARS and NASS/GES from calendar years 1995 to 2001. FARS and NASS/GES data show that during the period of the study 1995 to 2001, DRLs reduced daylight two passenger vehicle opposite-direction crashes by about 5 percent. DRLs have also been shown to reduce fatal opposite direction crashes between a motorcycle and a passenger vehicle by 23 percent. The results for two-vehicle daytime opposite-direction crashes are statistically significant at the $p < 0.10$ level, although one would prefer a statistical level of
$p < 0.05$.

FARS data were also used to estimate the effectiveness, based on the simple odds, of DRLs in reducing pedestrian/cyclist fatalities in single-vehicle fatal crashes. The analysis shows that DRLs reduced pedestrian/cyclist fatalities by more than 12 percent. These results are highly significant at a statistical level of $p = 0.002$.

This analysis is based on US historical data and does not reflect what will happen in the future. The techniques used do not predict the crash reducing effectiveness of DRLs if the entire fleet is equipped with DRLs nor if drivers become habituated to DRLs. These are limitations of historical crash data.

As additional data become available it may be appropriate to further investigate the effectiveness of DRLs in a variety of crash configurations including pedestrian and motorcycle crashes.

Appendix A

Analytic Approach

The primary analytic approach used to estimate the effectiveness, E, of daytime running lamps is based on the generalized simple odds. The effectiveness, based on the simple odds approach, is defined as:

$$E = 1 - e^{\beta}$$

Where ß is the coefficient of the following equation:

$$TC\_DT = \beta * DRL + S_i\ ?_i * X_i + error$$

Where: TC_DT = 1 if the crash is a target crash that occurred during the day, 0 otherwise and DRL = 0 if the vehicle has DRLs, otherwise 1. A bivariate logistic fit of the data is calculated using a maximum likelihood estimate. FARS data can be analyzed using SAS®, however, since NASS/GES data come from a complex survey rather than a census, SUDAAN had to be used to estimate the variance and significance of the estimated coefficients.

In the event that one does not need to control for variables such as vehicle type, the X_i terms are zero and an arithmetic approach to calculate the effectiveness exists. In this case, the effectiveness, E is equivalent to:

$$E = 1 - (O_{DRL}/O_{CMP})$$

Where

$$O = TD/(CD+TN+CN)$$

and is evaluated for both the vehicles equipped with DRLs, O_{DRL}, and the vehicles in the comparison group without DRLs, O_{CMP}.

TD is the number of vehicles/persons in Targeted crashes during Daylight.

CD is the number of vehicles/persons in Comparison crashes during Daylight.

TN is the number of vehicles/persons in Targeted crashes at Night.

CN is the number of vehicles/persons in Comparison crashes at Night.

In this simplified case, for FARS data, the variance of ln (1-E), can be estimated as the sum of the squared of the reciprocals of the four groups of observations. That is:

$$VAR[\ln(1-E)] \approx [1/TD_{DRL}]^2 + [1/(CD_{DRL} + TN_{DRL} + CN_{DRL})]^2 + [1/TD_{CMP}]^2 + [1/(CD_{CMP} + TN_{CMP} + CN_{CMP})]^2$$

This technique to estimate the variance of the ln(1-E) does not apply to weighted survey data, which requires complex software such as SUDAAN.

Logistic Regression Estimates Using the Simple Odds

Note that, with the exception of Table A-4, the value of p for the coefficient of DRL is < 0.1.

Table A-1
DRL Effectiveness in Fatal Two-Vehicle Crashes Based on Simple Odds

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	1.4450	0.0242	3,577.07	<0.0001
DRL	0.947	-0.0541	0.0278	3.79	0.0515

Source: NHTSA, NCSA, FARS, SAS®

Table A-2
DRL Effectiveness in Fatal Two-Vehicle Crashes / Adjusted for Vehicle Type Based on Simple Odds

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	1.4902	0.0270	3,053.61	< 0.0001
DRL	0.949	-0.0523	0.0279	3.52	0.0606
Sport Utility	1.211	0.1917	0.0356	29.01	<0.0001
Van	0.475	-0.2938	0.0442	44.11	<0.0001
Light Trucks	0.817	-0.2025	0.0283	51.10	<0.0001

Source: NHTSA, NCSA, FARS, SAS®

Table A-3 DRL Effectiveness in Non-Fatal Two-Vehicle Crashes Based on Simple Odds					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	-0.3579	0.05	3.33	0.0751
DRL	0.948	-0.0529	0.03	3.33	0.0751
Source: NHTSA, NCSA, NASS/GES, SUDAAN					

Table A-4 DRL Effectiveness in Non-Fatal Two-Vehicle Crashes / Adjusted for Vehicle Type Based on Simple Odds					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	-0.3779	0.13	3.74	0.0017
DRL	0.956	-0.0445	0.03	2.34	0.1333
Sport Utility	1.099	0.0941	0.05	4.30	0.0441
Van	0.826	-0.1906	0.08	6.13	0.0173
Light Trucks	1.089	0.0856	0.05	3.53	0.0672
Source: NHTSA, NCSA, NASS/GES, SUDAAN					

Table A-5 DRL Effectiveness in Fatal Single-Vehicle – Pedestrian/Cyclist Crashes Based on Simple Odds					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	3.0883	0.0384	6,476.45	<0.0001
DRL	0.876	-0.1318	0.0435	9.19	0.0024
Source: NHTSA, NCSA, FARS, SAS®					

Table A-6 DRL Effectiveness in Fatal Single-Vehicle – Pedestrian/Cyclist Crashes Adjusted for Vehicle Type Based on Simple Odds					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	3.1449	0.0427	5,424.56	<0.0001
DRL	0.871	-0.1377	0.0437	9.94	0.0016
Sport Utility	1.231	0.2082	0.0527	15.58	<0.0001
Van	0.812	-0.2086	0.0586	12.69	0.0004

Light Trucks	0.752	-0.2853	0.0445	41.08	<0.0001

Source: NHTSA, NCSA, FARS, SAS®

Table A-7
DRL Effectiveness for Two-Vehicle Fatal Crashes Involving a Motorcycle and a Passenger Vehicle Based on Simple Odds

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	4.8552	0.1275	1,450.52	<0.0001
DRL	0.768	-0.2645	0.1431	3.42	0.0645

Source: NHTSA, NCSA, FARS, SAS®

Table A-8
DRL Effectiveness for Two-Vehicle Fatal Crashes Involving a Motorcycle and a Passenger Vehicle Adjusted for Vehicle Type Based on Simple Odds

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	5.1603	0.1478	1,224.38	<0.0001
DRL	.0774	-0.2564	0.1436	3.19	0.0741
Sport Utility	0.627	-0.4664	0.1572	8.80	0.0030
Van	0.499	-0.6960	0.2044	11.60	0.0007
Light Trucks	0.557	-0.5846	0.1408	17.25	<0.0001

Source: NHTSA, NCSA, FARS, SAS®

Appendix B

Alternate Analytic Approach

This section is included at the request of the reviewers of the paper. The odds ratio is easier to understand for inexperienced analysts than the simple odds and, like the simple odds, attempts to control for a variety of factors other than the presence or absence of DRLs. Unfortunately, when using the odds ratio, the estimated effectiveness of DRLs is extremely sensitive to small changes encountered in real world crash data and none of the results were statistically significant. This does not mean that DRLs do not reduce target crashes during the daytime. It just means that the odds ratio technique does not detect these changes over the inherent background noise of the data system.

The effectiveness, based on the odds ratio, is defined as:

$$E = 1 - e^{ß}$$

Where ß is the coefficient of the following equation:

$$LIGHT = ß*(DRL \times CRASH) + a_1*DRL + a_2*CRASH + S_i\ ?_i*X_i + error$$

Where: LIGHT = 1 if the crash occurred during the day, 0 otherwise
DRL = 0 if the vehicle has DRLs, otherwise 1.
CRASH =1 if the crash is a target crash, and 0 if the crash is a comparison crash.

A bivariate logistic fit of the data is calculated using a maximum likelihood estimate. FARS data can be analyzed using SAS®, however, since NASS/GES data come from a complex survey rather than a census, SUDAAN had to be used to estimate the variance and significance of the estimated coefficients.

In the event that one does not need to control for variables such as vehicle type, the X_i terms are zero and an arithmetic approach to calculate the effectiveness exists. In this case, the effectiveness, E is equivalent to:

$$E = 1-(?_{DRL}/?_{CMP})$$

Where

$$? = (TD/CD)/(TN/CN)$$

and is evaluated for both the vehicles equipped with DRLs, $?_{DRL}$, and the vehicles in the comparison group without DRLs, $?_{CMP}$.

In this simplified case, for FARS data, the variance of ln (1-E), can be estimated as the sum of the squares of the reciprocals of the eight groups of observations. That is:

$$VAR[\ln(1-E)] \approx [1/TD_{DRL}]^2 + [1/CD_{DRL}]^2 + [1/TN_{DRL}]^2 + [1/CN_{DRL}]^2 + [1/TD_{CMP}]^2 + [1/CD_{CMP}]^2 + [1/TN_{CMP}]^2 + [1/CN_{CMP}]^2$$

Note that VAR [ln(1-E)] is much larger for the odds ratio than for the simple odds. As a result, the values of p, for each of the evaluated crash types in this study, are larger than 0.1, therefore the null hypothesis cannot be rejected and there is no reason to believe that the results, based on the odds ratio, did not occur by chance.

Using the data of Tables 2 and 3, the estimates of effectiveness of DRLs are calculated using the odds ratio. The result for two-vehicle opposite direction fatal crashes is –6.3 percent with (p=**0.229**). When adjusting for vehicle type, the result is –6.3 percent with (p=**0.235**). The values of p in both cases are larger than 0.1, therefore the null hypothesis cannot be rejected and there is no reason to believe that the results, based on the odds ratio, did not occur by chance.

Using the data of Tables 4 and 5, the estimates of effectiveness of DRLs are calculated using the odds ratio. The result for two-vehicle opposite direction non-fatal crashes is –7.9 percent with (p=**0.186**). When adjusting for vehicle type, the result is –7.6 percent with (p=**0.202**). The values of p in both cases are larger than 0.1, therefore the null hypothesis cannot be rejected and there is no reason to believe that the results, based on the odds ratio, did not occur by chance.

Using the data of Tables 6 and 7, the estimates of effectiveness of DRLs are calculated using the odds ratio. The result for fatal single-vehicle pedestrian/cyclist crashes is 3.8 percent with (p=**0.498**). When adjusting for vehicle type, the result is 4.6 percent with (p=**0.415**). The values of p in both cases are larger than 0.1, therefore the null hypothesis cannot be rejected and there is no reason to believe that these results, based on the odds ratio, did not occur by chance.

Using the data of Tables 8 and 9, the estimates of effectiveness of DRLs are calculated using the odds ratio. The result for crashes of a passenger vehicle with a motorcycle is 26.0 percent with (p=**0.284**). When adjusting for vehicle type, the result is 22.0 percent with (p=**0.335**). The values of p in both cases are larger than 0.1, therefore the null hypothesis cannot be rejected and there is no reason to believe that the results, based on the odds ratio, did not occur by chance.

Logistic Regression Estimates Using the Odds Ratio

Note that the value of p for the coefficient of DRLxCRASH is always larger than 0.1. Therefore the null hypothesis cannot be rejected and the estimates, based on the odds ratio, do not improve our understanding of the effectiveness of DRLs. However, if the estimate of effectiveness is larger than 20 percent, the estimates, based on the odds ratio, are similar to the estimates calculated using the simple odds, albeit not statistically significant.

Table B-1
DRL Effectiveness in Fatal Two-Vehicle Crashes Based on Odds Ratio

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	0.3082	0.227	184.01	<0.0001
DRLxCRASH	1.063	0.0608	0.0506	1.45	0.2291
DRL	0.980	-0.0204	0.0263	0.60	0.4381
CRASH	0.363	0.3082	0.0441	527.08	<0.0001
Source: NHTSA, NCSA, FARS, SAS®					

Table B-2
DRL Effectiveness in Fatal Two-Vehicle Crashes / Adjusted for Vehicle Type
Based on Odds Ratio

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	0.4052	0.0247	269.55	< 0.0001
DRLxCRASH	1.063	0.0606	0.0507	1.43	0.2315
DRL	0.998	-0.0019	0.0264	0.01	0.9435
CRASH	0.361	-1.0193	0.0442	531.82	<0.0001
Sport Utility	0.738	-0.3036	0.0273	123.75	<0.0001
Van	0.604	-0.5044	0.0689	167.83	<0.0001
Light Trucks	0.920	-0.0836	0.0237	12.43	<0.0004
Source: NHTSA, NCSA, FARS, SAS®					

Table B-3 DRL Effectiveness in Non-Fatal Two-Vehicle Crashes Based on Odds Ratio					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	-0.1343	0.08	222.88	<0.0001
DRLxCRASH	1.079	0.0763	0.06	1.81	0.1259
DRL	0.944	-0.0574	0.05	1.56	0.2184
CRASH	0.253	-1.3725	0.07	383.31	<0.0001
Source: NHTSA, NCSA, NASS/GES, SUDAAN					

Table B-4 DRL Effectiveness in Non-Fatal Two-Vehicle Crashes / Adjusted for Vehicle Type Based on Odds Ratio					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	-0.0957	0.08	141.85	<0.0000
DRLxCRASH	1.076	0.0735	0.06	1.68	0.2024
DRL	-0.954	-0.0467	0.05	0.97	0.3294
CRASH	0.253	-1.3728	0.07	387.03	<0.0000
Sport Utility	0.921	-0.0825	0.04	5.20	0.0276
Van	0.718	-0.3320	0.06	33.31	<0.0000
Light Trucks	1.089	0.0856	0.03	5.05	0.0237
Source: NHTSA, NCSA, NASS/GES, SUDAAN					

Table B-5 DRL Effectiveness in Fatal Single-Vehicle – Pedestrian/Cyclist Crashes – Based on Odds Ratio					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	0.2577	0.0168	235.46	<0.0001
DRLxPERSON	0.962	-0.0389	0.0575	0.46	0.4984
DRL	0.987	-0.0134	0.0193	0.42	0.4877
PERSON	0.876	-0.1318	0.0435	9.19	0.0024
Source: NHTSA, NCSA, FARS, SAS®					

Table B-6 DRL Effectiveness in Fatal Single-Vehicle – Pedestrian/Cyclist Crashes Adjusted for Vehicle Type Based on Odds Ratio					
Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	0.4387	0.0186	554.10	<0.0001
DRLxPERSON	0.954	-0.0472	0.0579	0.66	0.4153
DRL	1.031	0.0309	0.0195	2.51	0.1133
PERSON	1.238	0.2137	0.0509	17.62	<0.0001
Sport Utility	0.619	-0.4790	0.0208	532.62	<0.0001
Van	0.461	-0.7749	0.0269	831.38	<0.0001
Light Trucks	0.846	-0.1667	0.0206	65.46	<0.0001
Source: NHTSA, NCSA, FARS, SAS®					

Table B-7
DRL Effectiveness for Two-Vehicle Fatal Crashes
Involving a Motorcycle and a Passenger Vehicle Based on Odds Ratio

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	0.3082	0.0227	184.01	<0.0001
DRLxCRASH	0.760	-0.2851	0.2568	1.15	0.2842
DRL	0.980	-0.0204	0.0263	0.60	0.4381
CRASH	0.356	-1.0341	0.2236	21.40	<0.0001

Source: NHTSA, NCSA, FARS, SAS®

Table B-8
DRL Effectiveness for Two-Vehicle Fatal Crashes
Involving a Motorcycle and a Passenger Vehicle Adjusted for Vehicle Type
Based on Odds Ratio

Parameter	Odds Ratio	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq p
Intercept	N/A	0.4268	0.0254	282.23	<0.0001
DRLxCRASH	0.780	-0.2485	0.2577	0.93	0.3349
DRL	1.003	0.0030	0.0264	0.01	0.9087
CRASH	0.355	-1.0363	0.2242	21.36	<0.0001
Sport Utility	0.691	-0.3695	0.0309	143.26	<0.0001
Van	0.529	-0.6362	0.0460	190.93	<0.0001
Light Trucks	0.905	-0.0993	0.0283	12.27	0.0005

Source: NHTSA, NCSA, FARS, SAS®

The following SAS® code was used to partition FARS 1996 vehicle crashes. The code for the NASS/GES is similar.

```
/* COMPARISON CRASHES SINGLE VEHICLE CRASHES */

LIBNAME FARS96 'L:\FARSSAS\FARS96';

DATA CRASH;
 SET FARS96.ACCIDENT(KEEP = ST_CASE LGT_COND VE_FORMS MAN_COLL
WEATHER);

LENGTH TGT_CRSH $8;

* IF TWO VEHICELES CRASH AND;
* HEAD-ON OR SIDESWIPE DIFFERENT DIRECTIONS;

IF (VE_FORMS EQ 2) AND
        ((2 EQ MAN_COLL) OR (6 EQ MAN_COLL))
        THEN TGT_CRSH ='MUL TGT';

/* ELSE SINGLE VEHICLE CRASHES */
ELSE IF (VE_FORMS EQ 1) THEN TGT_CRSH = 'SINGLE';
ELSE DELETE;

*DEFINE THE DICHOTOMOUS VARIABLE D_CRASH;

IF (VE_FORMS EQ 2) AND
        ((2 EQ MAN_COLL) OR (6 EQ MAN_COLL))
        THEN D_CRASH = 1;

/* ELSE SINGLE VEHICLE CRASHES */
ELSE IF (VE_FORMS EQ 1) THEN D_CRASH = 0;
ELSE DELETE;

LENGTH LIGHT $7;

*IF DAYLIGHT DAWN OR DUSK;
IF (LGT_COND EQ 1 OR 4 LE LGT_COND LE 5) THEN LIGHT = 'DAYTIME';

*IF DARK OR DARK AND LIGHTED;
ELSE IF (2 LE LGT_COND LE 3) THEN LIGHT = 'NIGHT';
```

```
ELSE DELETE;

*  DEFINE THE DICHOTOMOUS VARIABLE D_LIGHT;
IF (LGT_COND EQ 1 OR 4 LE LGT_COND LE 5) THEN D_LIGHT = 1;
ELSE IF (2 LE LGT_COND LE 3) THEN D_LIGHT = 0;

* DEFINE THE DICHOTOMOUS VARIABLE MUL_DAY;
* THIS IS FOR THE SIMPLE ODDS CALCULATION;

IF (D_CRASH = 1 AND D_LIGHT = 1) THEN MUL_DAY =1;
ELSE MUL_DAY = 0;
```

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2950

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2951

Attachment F

SWOV Fact Sheet, "Daytime Running Lights (DRL)," SWOV Institute for Road Safety Research, 2004, *http://www.swov.nl/index_uk.htm*

SWOV Fact sheet

Daytime running lights (DRL)

Summary
In 2008, the Dutch Ministry of Transport announced its intention to run an information campaign to stimulate the use of daytime running lights (DRL). 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 2008, the Dutch Ministry of Transport announced its intention to promote DRL use with an information campaign.
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 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. 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. It is also an advantage that vulnerable road users can see cars with DRL sooner than cars without DRL.
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. 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.

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 CO_2 emissions of car traffic increase by 0.6-1.4% (Elvik et al., 2003). Saving fuel and reducing CO_2 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).
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. Nowadays dipped lights are quite well adjusted because of the MOT and built-in systems that ensure an automatic adjustment of headlights. Blinding does not occur with lamps that have been specially developed for DRL purposes.

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*;

2954

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.

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[1] compulsory DRL has been abolished as of 1 January 2008.
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.

[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*)

2955

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 3[1]	In favour of option 5[2]	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 or solely vehicle demands for DRL. At this moment it is still unclear when the European Commission will make a definite decision on this issue. While awaiting possible European legislation for new vehicles, the Netherlands has intended to conduct a government campaign to stimulate voluntary DRL use.

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. 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. For the time being, such a behavioural measure will not be taken in the Netherlands. However, a campaign will be conducted to stimulate voluntary DRL use. 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.

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Attachment G

"Q&A: Daytime Running Lights," *Business Week*, December 2005,
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SAFETY TIPS

Q&A: Daytime Running Lights

as of December 2005

1. What are the safety advantages of DRLs? Daytime running lights (DRLs) are a low-cost method to reduce crashes. They are especially effective in preventing daytime head-on and front-corner collisions by increasing vehicle conspicuity and making it easier to detect approaching vehicles from farther away.

2. Where are DRLs required? Laws in Canada, Denmark, Finland, Hungary, Iceland, Norway, and Sweden require vehicles to operate with lights on during the daytime. There are two types of laws. Canada's requires vehicles to be equipped with DRLs. The other type of law (in effect in Denmark, Finland, Hungary, Iceland, Norway, and Sweden) requires motorists to turn on their headlights if their vehicles do not have automatic DRLs. In 1972, Finland mandated daytime running lights in winter on rural roads and a decade later made DRLs mandatory year-round. Sweden's law took effect in 1977, Norway's in 1986, Iceland's in 1988, and Denmark's in 1990. Hungary has required drivers on rural roads to operate with vehicle lights on since 1993. Canada requires DRLs for vehicles made after December 1, 1989. No U.S. state mandates DRLs, but some require drivers to operate vehicles with lights on in bad weather.

3. Are DRLs available on vehicles in the United States? First offered on a handful of 1995 domestic and foreign model passenger cars, pickups, and SUVs, daytime running lights are becoming a more common feature. They are standard on all General Motors, Lexus, Mercedes Benz, Saab, Subaru, Suzuki, Volkswagen, and Volvo models as well as some Toyota models. GM offers retrofit kits for vehicles that do not already have DRLs. The kits can be used on non-GM models, too.

4. How effective are DRLs? Nearly all published reports indicate DRLs reduce multiple-vehicle daytime crashes. Evidence about DRL effects on crashes comes from studies conducted in Scandinavia, Canada, and the United States. A study examining the effect of Norway's DRL law from 1980 to 1990 found a 10 percent decline in daytime multiple-vehicle crashes.[1] A Danish study reported a 7 percent reduction in DRL-relevant crashes in the first 15 months after DRL use was required and a 37 percent decline in left-turn crashes.[2] In a second study covering 2 years and 9 months of Denmark's law, there was a 6 percent reduction in daytime multiple-vehicle crashes and a 34 percent reduction in left-turn crashes.[3] A 1994 Transport Canada study comparing 1990 model year vehicles with DRLs to 1989 vehicles without them found that DRLs reduced relevant daytime multiple-vehicle crashes by 11 percent.[4]

In the United States, a 1985 Institute study determined that commercial fleet passenger vehicles modified to operate with DRLs were involved in 7 percent fewer daytime multiple-vehicle crashes than similar vehicles without DRLs.[5] A small-scale fleet study conducted in the 1960s found an 18 percent lower daytime multiple-vehicle crash rate for DRL-equipped vehicles.[6] Multiple-vehicle daytime crashes account for about half of all police-reported crashes in the United States. A 2002 Institute study reported a 3 percent decline in daytime multiple-vehicle crash risk in nine U.S. states concurrent with the introduction of DRLs.[7] Federal researchers, using data collected nationwide, concluded that there was a 5 percent decline in daytime, two-vehicle, opposite-direction crashes and a 12 percent decline in fatal crashes with pedestrians and bicyclists.[8]

5. Will DRLs shorten headlamp bulb life or lower fuel economy? Running vehicle lights in the daytime does not significantly shorten bulb life. Systems like those on General Motors cars that use high beams are designed to operate at half their normal power during daylight hours, thereby conserving energy and reducing the effect on a vehicle's fuel economy. The National Highway Traffic Safety Administration (NHTSA) estimates that only a fraction of a mile per gallon will be lost, depending on the type of system used. GM estimates the cost to be about $3 per year for the average driver. Transport Canada estimates the extra annual fuel and bulb replacement costs to be $3-15 for systems using reduced-intensity headlights or other low-intensity lights and more than $40 a year for DRL systems using regular low-beam headlights.

6. Will motorists be bothered by glare? In most countries mandating DRLs, glare has not been an issue. However, some motorists in the

United States have complained that the systems here are too bright. In response to these complaints, NHTSA in 1998 proposed reducing the maximum allowable light intensity from 7,000 to 1,500 candela, a value more in line with European DRLs. There has been no action on this proposal as yet.

7. Are motorcycles required to have DRLs? Federal law does not require motorcycles to have DRLs, but some states require motorcyclists to ride with their headlights on at all hours. Thus, since 1979 most manufacturers have equipped their cycles with automatic-on headlamps.

References

[1]Elvik, R. 1993. The effects on accidents of compulsory use of daytime running lights for cars in Norway. *Accident Analysis and Prevention* 25:383-98.

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[4]Arora, H.; Collard, D.; Robbins, G.; Welbourne, E.R.; and White, J.G. 1994. Effectiveness of daytime running lights in Canada. Report no. TP-12298. Ottawa, Ontario: Transport Canada.

[5]Stein, H. 1985. Fleet experience with daytime running lights in the United States. SAE Technical Paper Series 851239. Warrendale, PA: Society of Automotive Engineers.

[6]Cantilli, E.J. 1970. Accident experience with parking lights as running lights. Highway Research Record 32. Washington, DC: Transportation Research Board.

[7]Farmer, C.M. and Williams, A.F. 2002. Effects of daytime running lights on multiple-vehicle daylight crashes in the United States. *Accident Analysis and Prevention* 34:197-203.

[8]Tessmer, J.M. 2004. An assessment of the crash-reducing effectiveness of passenger vehicle daytime running lamps (DRLs). Report no. DOT HS-809-760. Washington, DC: National Highway Traffic Safety Administration.

Headlights On At All Times Law (SB73 - 2009)
Estimate of Sign Cost

Community/Area	Location	No of Signs
Prudhoe Bay	Departing South, Dalton Hwy	1
Fairbanks	Departing, Steese, Parks, Richardson	3
Delta	Departing, Richardson, Alaska Hwy N&S	3
Tok	Departing, Tok Cutoff W, Alaska Hwy N&S	3
Alaska Border-Alaska Hwy	For W-bound arrivals	1
Glenallen	Departing, Glen W, Richardson N&S	3
Wasilla	Departing, Parks Hwy N	1
Palmer	Departing, Glen Hwy E	1
Valdez	Departing Richardson Hwy N	1
Glen-Parks Interchange	Departing Glen E, Glen S, Parks N	3
Anchorage	Airport	2
	Departing South-Seward Hwy	1
	Departing North, Glen Hwy	1
Kenai	Airport	1
Seward	Departing, Seward Hwy N	1
Soldotna	Airport	1
	Departing, Sterling Hwy N&S	2
Homer	Departing, Sterling Hwy N	1
Haines	Departing Haines Hwy N	1
Alaska Border-Haines	For S-bound arrivals	1
Skagway	Departing Klondike Hwy N	1
Alaska Border-Klondike	For S-bound arrivals	1
Juneau	Ferry Terminal	1
	Airport, Yandukin& Shell Simmons	2
Ketchikan	Ferry Access to Airport-both sides on Tongass	2

Intent:

Install signs at:
Major Airports
Major Ferry Terminals
At Major Junctions
At border crossings

We want to minimize the number of signs- just post at major entry points or junctions of high volume roads

39 Signs

4 Line Sign

	7	ft. wide
	4.5	ft. tall
	31.5	s.f.
	110	$/s.f.
	3465	Sign Cost
$	**135,135**	Total