SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J2087

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DAYTIME RUNNING LAMPS FOR USE ON MOTOR VEHICLES

1. Scope—This SAE Recommended Practice provides test procedures, requirements, and guidelines for daytime running lamps that are mounted on the exterior of a vehicle. It is applicable to daytime running lamps that are combined with or use headlamps, parking lamps, turn signal lamps, fog lamps, or other lamps on the front of the vehicle, as well as to daytime running lamps that use dedicated lamps.

2. References

2.1 Applicable Documents—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1. SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J567—Lamp Bulb Retention System

SAE J575—Tests for Motor Vehicle Lighting Devices and Components

SAE J576—Plastic Materials for Use in Optical Parts Such as Lenses and Reflectors of Motor Vehicle Lighting Devices

SAE J578—Color Specifications for Electric Signal Lighting Devices

SAE J759—Lighting Identification Code

SAE J1050—Describing and Measuring the Driver's Field of View

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

SAE Lighting Committee DRL Test Reports, 1974-1989, nine separate reports.

CIE TC4.13 Report—Automobile Daytime Running Lights (DRL), Third Draft, July 1990.

Canadian Motor Vehicle Safety Standard 108—Light Equipment

2.3 Definitions

2.3.1 DAYTIME RUNNING LAMPS (DRL)—Steady burning lamps that are used to improve the conspicuity of a vehicle from the front and front sides when the regular headlamps are not required for driving.

2.3.2 DAYTIME RUNNING LAMP TELLTALE—An indicator that provides a visual signal to advise the driver that only his daytime running lamps are on and he should switch on the regular headlamps.

3. Lighting Identification Code—Daytime running lamps meeting the performance requirements of Section 5 of this document may be identified by the code Y2 in accordance with SAE J759.

4. Tests

4.1 SAE J575 is a part of this document. The following tests, from that document, are applicable with the modifications as indicated.

4.1.1 VIBRATION TEST

4.1.2 MOISTURE TEST

4.1.3 DUST TEST

4.1.4 CORROSION TEST

4.1.5 PHOTOMETRY—In addition to the test procedures in SAE J575, the following applies:

Photometric measurements shall be made with the light source of the DRL at least 3 m from the photometer. If the DRL is optically combined with a headlamp or a fog lamp then the photometric measurements shall be made with the light source of the DRL at least 18.3 m from the photometer.

4.1.6 WARPAGE TEST ON DEVICES WITH PLASTIC COMPONENTS—The bulb operation for this test shall be steady burning.

4.1.7 COLOR TEST—SAE J578 is a part of this document.

5. Requirements

5.1 **Performance Requirements**—A DRL, when tested in accordance with the test procedures specified in Section 4, shall meet the following requirements:

5.1.1 VIBRATION—SAE J575

5.1.2 MOISTURE—SAE J575

5.1.3 DUST—SAE J575

5.1.4 CORROSION—SAE J575

5.1.5 PHOTOMETRY—SAE J575—The DRL under test shall meet the photometric requirements contained in Table 1.

5.1.6 WARPAGE—SAE J575

5.1.7 COLOR—SAE J578—The color of the light from a DRL shall be white, white to yellow, white to selective yellow, yellow, or selective yellow as specified in SAE J578.

5.2 **Materials Requirements**—Plastic materials used in optical parts shall meet the requirements of SAE J576.

5.3 **System Requirements**—A DRL system shall consist of at least two lamps.

5.3.1 LOCATION REQUIREMENTS—The DRLs shall be located on the front, at the same mounting height, and symmetrically placed laterally relative to the centerline of the vehicle.

5.3.2 AREA REQUIREMENTS—The DRLs shall have a minimum unobstructed effective projected luminous lens area of 40 cm^2. In addition the DRL must provide an unobstructed view of the outer lens surface of at least 10 cm^2 measured at 45 degrees to the longitudinal axis of the vehicle.

6. Guidelines

6.1 Photometric Design Guidelines for DRLs, when tested in accordance with 4.1.5 of this document, are contained in Table 2.

6.2 **Luminous Flux Maintenance Guideline**—The applicable luminous flux maintenance test cycle established to verify the performance of halogen bulbs used at reduced voltages in daytime running lamps

TABLE 1—PHOTOMETRIC REQUIREMENTS

Test Point	Minimum Candela	Maximum Candela
5U - 10L	80	
5U - V	280	
5U - 10R	80	
H - 20L	40	
H - 10L	280	
H - 5L	360	
H - V	400	7000
H - 5R	360	
H - 10R	280	
H - 20R	40	
5D - 10L	80	
5D - V	280	
5D - 10R	80	

is shown in Table 3. Testing is to be done at room temperature with a steady-state DC applied voltage as specified in Table 3. It is not required to use AC, pulse width modulators, or dropping resistors but they may be used if desired to obtain the voltage as specified in Table 3.

6.2.1 Season the filament(s) and measure the original luminous flux output of the filament(s) in a spherical photometer at 12.8 V DC. Test the light source mounted in a 100 x 165 mm sealed beam size enclosure through 24 cycles where a test cycle is as defined in Table 3 and is sequenced from the same starting point in each cycle. Measure the final luminous flux output of the filament(s) after testing.

TABLE 2—PHOTOMETRIC DESIGN GUIDELINES

Test Point	Minimum Candela	Maximum Candela
5U - 10L	100	
5U - V	350	
5U - 10R	100	
H - 20L	50	
H - 10L	350	
H - 5L	450	
H - V	500	7000
H - 5R	450	
H - 10R	350	
H - 20R	50	
5D - 10L	100	
5D - V	350	
5D - 10R	100	

After the testing (see equation 1):

$$\frac{LUBF}{LUBO} \geq 95\% \quad \frac{LLBF}{LLBO} \geq 95\% \qquad \text{(Eq. 1)}$$

where:

LUBF = Lumens Upper Beam, Final

LUBO = Lumens Upper Beam, Original

LLBF = Lumens Lower Beam, Final

LLBO = Lumens Lower Beam, Original

6.3 Telltale Guidelines—A DRL Telltale, if provided, shall be located on the instrument panel or in the driver's forward field of view. If a light sensor is used to activate the telltale, the sensor should be up-

TABLE 3—TEST CYCLE

Lighting Mode	Lighting Mode	Voltage(V)	H/L Using Upper Beam For DRL Double-Fil. Period (h)	H/L Using Upper Beam For DRL Single-Fil. Period (h)	H/L Using Lower Beam For DRL Double-Fil. Period (h)	H/L Using Lower Beam For DRL Single-Fil. Period (h)
Headlamp	Upper Beam	12.8	0.25	0.25	0.25	—
(Nighttime)	Lower Beam	12.8	1.0	—	1.0	1.0
DRL	Upper Beam	6.4	6.25	6.25	—	—
(Daytime)	Lower Beam	10.5	—	—	6.25	6.25
OFF	OFF	0	0.5	1.5	0.5	0.75
Total (1 Cycle)	Total (1 Cycle)		8.0	8.0	8.0	8.0

ward pointing and activate the telltale when the ambient light level is less than 1000 lux, indicating dusk, night, or other reduced light conditions. If a light sensor is not used the telltale should provide a visual signal when the ambient light level, as measured by an upward pointing sensor, is less than 1000 lux, indicating dusk, night, or other reduced light conditions. The telltale is used to indicate to the driver:

a. The DRLs are still illuminated and the ambient light level indicates the headlamps should be illuminated or

b. The headlamps should be turned on.

The telltale may deactivate when the headlamps are switched on.

6.3.1 The telltale may also function as a bulb failure indicator for any exterior lighting functions.

6.3.2 The telltale should emit yellow colored light and have a minimum projected illuminated area of 18 mm^2. The minimum required illuminated area of the telltale shall be visible according to the procedures contained in SAE J1050. The steering wheel shall be turned to a straight-ahead position and in the design location for an adjustable wheel or column.

6.3.3 A DRL telltale need not be installed on vehicles having the following lighting equipment:

a. Lower beam headlamps operating at full voltage used as DRLs, with all exterior marking lamps activated by the DRL system or

b. An automatic photocell system for switching between DRL and night exterior lighting modes, unless this device can be manually switched to an inoperative status.

6.4 Operating Guidelines—These guidelines apply to how DRLs are used on the vehicle and are not part of the requirements.

6.4.1 The DRLs are to be activated without any switching by the operator (apart from the ignition switch).

6.4.2 No other lights are required to be illuminated with the DRLs unless full intensity low beam headlamps are used as the DRLs. In this case those exterior lamps that are required to be illuminated with the low beam headlamps are to be illuminated with the DRLs.

6.4.3 The DRLs are to be deactivated when the low beam or high beam headlamps are turned on.

6.5 Installation Guidelines—For DRLs to be most effective they should be spaced as far apart laterally as practicable, to maximize the field of view and to facilitate estimation of distances by drivers in approaching vehicles.

DRLs should be designed to be mounted on the vehicle so the centers of the lenses are not less than 380 mm (15 in) nor more than 1820 mm (72 in) above the road surface.

6.6 Color Guidelines—The color of the emitted light from all DRLs on a vehicle shall be designed to be the same (see 5.1.7).

PREPARED BY THE SAE DRL TASK FORCE OF THE
SAE LIGHTING COORDINATING COMMITTEE

Appendix A

A.1 For information on requirements and gages used in socket design, refer to SAE J567.

Rationale—DRLs have been studied for over twenty years in the U.S. Their use has now been mandated in several countries. The purpose of DRLs is two-fold. One is to increase the long-range straight-ahead conspicuity of an oncoming vehicle in a two lane passing situation while the second is to increase the wide angle conspicuity of a vehicle at short distances (e.g., at intersections or crossings). DRLs increase the attention-getting features of a vehicle over a vehicle without DRLs.

The SAE Lighting Committee has conducted several tests during the last few years. These tests have investigated various intensities, colors, beam patterns, and functions. There have also been many different test conditions. One main result has always occurred: A DRL equipped vehicle is more conspicuous than a vehicle without DRLs. This also had appeared in fleet tests that have been conducted since 1960: The DRL-equipped vehicles always had a lower accident rate than the vehicles without DRLs.

Because the two main purposes of DRLs use different portions of the beam pattern it is necessary that the pattern be somewhat of a compromise. A narrow "pencil" beam would be most effective in the two lane passing situation but it would not be most effective in the wide angle intersection situation. Thus the proposed beam pattern has a minimum required intensity at H-V to provide long distance conspicuity and minimum required wide angle spread intensity to provide conspicuity at intersections.

A report has been written for every one of the SAE Lighting Committee DRL tests. These reports provide the experimental basis for this document. A summary of these SAE tests are included with this rationale. An excellent summary document concerning DRL is the CIE TC4.13 report "Automobile Daytime Running Lights."

Canada is the first country in North America to mandate DRLs. The Canadian regulation is rather broad and allows many types of lamps to provide the DRL on a vehicle. This supports the claim that "almost anything used for a DRL is better than nothing." This document proposes DRLs that should be closer to the optimum system.

The following are comments relating to revisions that have been made as the result of the previous ballots. These explanations serve as part of the rationale of this document.

1. The words "SAE J575" have been added back to Paragraph 5.1.5 because the photometry section of J575 does list some requirements.
2. The test procedure incorrectly placed in Paragraph 5.1.6 was moved to Paragraph 4.1.6.
3. The paragraphs concerning the telltale have been moved to the guidelines section, Paragraph 6.3. The remaining paragraphs were renumbered. Comments about the telltale paragraphs are:
   a. 1000 lux is a twilight condition. The light level in Washington, DC at one of the SAE tests was 500 lux at sunset. At 6 min before sunset the ambient light level was 1000 lux.
   b. Because the telltale is not now a requirement some words had to be revised.
   c. A definition of DRL telltale was added.
   d. In the new Paragraph 6.3.3b the wording now indicates that if the automatic DRL-headlamp switching device can be manually deactivated then the telltale should be installed and operational.
4. The Scope was changed to clearly mention the applicability of this document to all DRL devices.
5. The specific test points in Tables 1 and 2 are needed to provide down the road and wide angle conspicuity. These test point locations are now in agreement with the test points proposed by CIE TC4.13. The intensity values are not the same as the report by CIE TC4.13. Four test points have been added at 5U-10L, 5U-10R, 5D-10L, and 5D-10R. The percentage of intensity at these new test points is the same as that proposed by CIE TC4.13 (20%) (0.20 x 500 = 100 cd).

   The test points at 5U-20L, 5U-20R, 5D-20L, and 5D-20R, suggested by some commenters, have not been included. The intensity value 50 cd and test point locations H-20L and H-20R will cause sufficient wide angle spread of the beam pattern.

SAE DAYTIME RUNNING LAMPS (DRL) TEST SUMMARY

DATE	LOCATION	COMMENTS
JANUARY, 1974	CHANDLER, ARIZONA	TYPE 1C ROUND, TYPE 2C ROUND UPPER BEAM, TYPE 1A RECTANGULAR UPPER BEAM; REDUCED CD OUTPUT; IDENTIFICATION DISTANCE; GLARE TEST; MIRROR GLARE TEST; EVALUATION OF DRL INTENSITY TO DRIVE AT DUSK; AFTERNOON AND DUSK.
OCTOBER, 1982	OTTAWA, CANADA	BOTH SPECIFIC EUROPEAN DRL AND REDUCED UPPER BEAM; STRAIGHT AHEAD AND PERIPHERAL EVALUATION OF INTENSITY TO IMPROVE CONSPICUITY; DAYTIME, SUNNY.
SEPTEMBER, 1984	DETROIT, MICHIGAN	REDUCED UPPER BEAM; IDENTIFICATION DISTANCE FOR IMPROVED CONSPICUITY; STRAIGHT AHEAD EVALUATION FOR GLARE; PARTIALLY SUNNY.
APRIL, 1985	SCOTTSDALE, ARIZONA	FULL AND REDUCED UPPER BEAM; YELLOW AND WHITE UNIFORM BEAM PATTERN; STRAIGHT AHEAD AND PERIPHERAL EVALUATION AT A SIMULATED INTERSECTION; BRIGHT SUN AND DUSK.
OCTOBER, 1985	INDIANAPOLIS, INDIANA	UPPER BEAM, LOW BEAM, FOG, TURN SIGNAL PATTERN AT SEVERAL INTENSITIES; STRAIGHT AHEAD AND OFFSET; STATIC AND DYNAMIC TESTING; BRIGHT SUN ONLY.
APRIL, 1986	SAN DIEGO, CALIFORNIA	UPPER BEAM, SEVERAL INTENSITIES; TURN SIGNAL, YELLOW AND WHITE; STRAIGHT AHEAD AND OFFSET; STATIC AND DYNAMIC TESTING; BRIGHT SUN ONLY.
MAY, 1987	ORLANDO, FLORIDA	AMBER TURN SIGNAL, REDUCED UPPER BEAM, FULL AND REDUCED LOW BEAM, FOG; SEVERAL INTENSITIES; ALL TESTS WERE STATIC; BRIGHT SUN AND DUSK.
OCTOBER, 1988	KANSAS CITY, MISSOURI	STRAIGHT AHEAD AND OFFSET AT INTERSECTION; CIE DRL BEAM PATTERN; 500 TO 2000CD; BRIGHT SUN AND DUSK.
SEPTEMBER 1989	WASHINGTON, DC	STRAIGHT AHEAD AND OFFSET AT INTERSECTION; 200-7000 CD; ALL WHITE; ALL TESTS WERE STATIC; BRIGHT SUN AND DUSK.

DATE: JANUARY 29, 1974

SITE: CHANDLER, ARIZONA

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY, TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES. COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC: STRAIGHT AHEAD, OFFSET, PERIPHERAL.	SUMMARY OF RESULTS
DAYTIME: AFTERNOON DUSK: 10 MINUTES BEFORE SUNSET, AT SUNSET, JUST AFTER SUNSET	REDUCED UPPER BEAM; ALL WHITE; 5-3/4" ROUND, TYPE 1 AND TYPE 2 UPPER BEAM FILAMENT; 300 cd TO 10000 cd	NO SECONDARY TASKS. A. VEHICLE RECOGNITION DISTANCE, STRAIGHT AHEAD, STATIC, DAYTIME 300 cd to 2000 cd 0 cd B. ACCEPTABLE GLARE TEST CAR MOVING, OBSERVERS STATIC IN CARS, 6000 cd TO 10000 cd DUSK. C. WILL YOU DRIVE AFTER DUSK WITH DRL LIGHTED? STATIC, 6000 cd AND 8000 cd TYPE 1 UPPER BEAM. D. IS INSIDE REARVIEW MIRROR GLARE OBJECTIONABLE AT DUSK? 6000 cd AND 8000 cd TYPE 1 UPPER BEAM, TEST CAR 60' BEHIND OBSERVERS. STATIC.	A. 4950 FT. AVERAGE 2100 FT. AVERAGE B. 80% ACCEPTED 7800 cd C. 50% OBSERVERS WOULD HAVE TURNED ON REGULAR LOW BEAM BY SIX MINUTES AFTER SUNSET. D. 80% ACCEPTED 7700 cd.

DATE: OCTOBER 5, 1982

SITE: OTTAWA, ONTARIO, CANADA

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY, TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES, COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC: STRAIGHT AHEAD, OFFSET, PERIPHERAL.	SUMMARY OF RESULTS
DAYTIME: AFTERNOON 14:30 TO 15:40; CLEAR SKY, NO CLOUDS, SUNNY. FACING NORTH	REDUCED UPPER BEAM, TYPE 2B1; 1000 cd TO 16000 cd. SPECIAL EUROPEAN DRL: 50 cd TO 700 cd.	ALL STATIC 50m TO 400m A. COMPARISON CAR HAD NO LIGHTS OR PARKING LIGHTS OR LOW BEAM OPERATING. B. GLARE EVALUATION, STRAIGHT AHEAD. C. STRAIGHT AHEAD WITH SECONDARY TASK OF TURN SIGNAL FLASHING. 15° AND 30° OFF AXIS AT 50m AND 100m.	A. OBSERVERS CONSIDERED 100 cd TO BE MORE CONSPICUOUS THAN CAR WITH ZERO OR PARKING LAMPS ON. LOW BEAM MORE CONSPICUOUS THAN DRL INTENSITY 50 cd TO 700 cd. B. 1000 cd, NO GLARE BY 88% OF OBSERVERS AT 400m, NO GLARE BY 69% OF OBSERVERS AT 50m. 1600 cd, EXCESSIVE GLARE BY 35% of OBSERVERS AT 400m, EXCESSIVE GLARE BY 63.5% OF OBSERVERS AT 50m. C. MOST INTENSITIES (50 cd TO 700 cd) NOT NOTICEABLE AT 15° OFFSET. SLIGHT INCREASE IN NOTICEABILITY AT 30° OFFSET. (PERIPHERAL VISION NOT VERY GOOD) ANY INTENSITY INCREASES CONSPICUITY OVER ZERO.

DATE: SEPTEMBER 26, 1984

SITE: DETROIT, MICHIGAN

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY, TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES, COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC: STRAIGHT AHEAD, OFFSET, PERIPHERAL.	SUMMARY OF RESULTS
DAYTIME: AFTERNOON 14:05; MOSTLY SUNNY, SOME CLOUDS. TEMPERATURE: 54°F OBSERVERS FACING WEST	UPPER BEAM PATTERN AT REDUCED INTENSITIES. ALL WHITE INTENSITIES: 0 TO 5000 cd.	NO SECONDARY TASKS. A. STATIC TESTING: STRAIGHT AHEAD 0.2 MILE TO 0.9 MILE. B. DYNAMIC TEST: GLARE EVALUATION DRL CAR DROVE BY OBSERVERS IN ADJACENT LANE WITH DRL AT 5000 cd.	A. 80% OF OBSERVERS COULD CLEARLY SEE 600 cd AT 0.5 MILE, ONLY 24% COULD SEE 200 cd. B. NO COMMENTS MADE THAT DRL'S WERE "TOO BRIGHT", "GLARING", OR "BLINDING".

DATE: APRIL 25, 1985

SITE: MESA, ARIZONA

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY, TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES, COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC. STRAIGHT AHEAD, OFFSET, PERIPHERAL.	SUMMARY OF RESULTS
14:10 TO 14:30 BRIGHT, SUNNY DAY CLEAR SKY VERY WINDY. OBSERVERS FACED EAST AND NORTH DUSK: BEFORE SUNDOWN 18:25 18:45 SUNDOWN AT 19:05 CLEAR SKY. NOT AS WINDY. OBSERVERS FACED EAST AND NORTH. SUN DIRECTLY BEHIND OBSERVERS	PATTERN O, 1500, 65000 cd. ALL WHITE FOR TEST A. UNIFORM SIGNAL LAMP BEAM PATTERN 200, 600, 1500 cd. BOTH WHITE AND AMBER. FOR TEST B LAMPS POSITIONED TO POINT TOWARD OBSERVER GROUP AS DISTANCE CHANGED.	OBSERVERS OFFSET 100' BACK FROM CENTERLINE OF ROAD (SIMULATING APPROACHING AN INTERSECTION.) A. TEST WAS FOR PERIPHERAL VISION EVALUATION SECONDARY TASKS OF COUNTING NUMBER OF TURN SIGNAL FLASHES. DISTANCES OF 100', 300', 500'. B. DRL SIGNAL EFFECTIVENESS. DISTANCES OF 100' 300', 500', 800'.	A. DURING DAYTIME MOST OBSERVERS DID NOT SEE FULL UPPER BEAM (65000 cd) OUT OF PERIPHERAL VISION, EVEN AT 100', (45°). AT DUSK, 50% OF OBSERVERS SAW FULL UPPER BEAM AT 100' IN PERIPHERAL VISION. B. DURING DAYTIME 80% OBSERVERS JUDGED 1500 cd TO BE EFFECTIVE AT 150'. ONLY 25% JUDGED 600 cd TO BE EFFECTIVE. NO SIGNIFICANT DIFFERENCE WHITE OR AMBER. AT DUSK, 1500 cd WAS EFFECTIVE AT ALL DISTANCES. 80% OF OBSERVERS JUDGED 600 cd EFFECTIVE AT 300'.

DATE: OCTOBER 2, 1985

SITE: INDIANAPOLIS, INDIANA

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY, TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES, COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC. STRAIGHT AHEAD, OFFSET, PERIPHERAL.	SUMMARY OF RESULTS
DAYTIME: AFTERNOON 14:15 TO 15:30 BRIGHT SUNNY DAY, CLEAR BLUE SKY	LOW BEAM 600, 1500, 5000 cd AT H-V. TURN SIGNAL 600 cd AT H-V. FOG LAMP 600, 1500 cd AT H-V. ALL WHITE EXCEPT AMBER TURN SIGNAL.	NO SECONDARY TASK. LAMPS ON EACH SIDE OF CAR WERE LIGHTED. OBSERVERS TO JUDGE MOST EFFECTIVE DRL. LAMPS ALWAYS HAD INTENSITY, SOMETIMES DIFFERENT BEAM PATTERN. A. DYNAMIC TEST. OBSERVERS WERE OFFSET APPROX. 25' FROM CENTERLINE OF PATH OF DRL CAR. OBSERVATIONS MADE 500' TO 250' WHEN DRL CAR WAS DRIVEN AT 30 MPH TOWARD OBSERVERS. DRL CAR ALTERNATED APPROACHING FROM LEFT AND RIGHT. B. STATIC TEST OBSERVER STRAIGHT AHEAD OF DRL CAR AT .45 MILES (APPROX. 2400').	A. AMBER TURN SIGNAL JUDGED MOST EFFECTIVE AT 600 cd. FOG LAMP JUDGED MOST EFFECTIVE AT 1500 cd. B. AMBER TURN SIGNAL JUDGED MOST EFFECTIVE AT 600 cd. LOW BEAM JUDGED MOST EFFECTIVE AT 1500 cd. WHEN LAMPS ON BOTH SIDES OF VEHICLE WERE EXACTLY THE SAME THERE WAS A SIGNIFICANT BIAS TO JUDGE THE RIGHT LAMP MORE EFFECTIVE.

DATE: APRIL 9, 1986 (PAGE 1 of 2)

SITE: SAN DIEGO, CALIFORNIA

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY, TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES, COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC: STRAIGHT AHEAD, OFFSET. PERIPHERAL.	SUMMARY OF RESULTS
DAYTIME: AFTERNOON 14:00 TO 15:30 BRIGHT SUNNY DAY. CLEAR BLUE SKY. TEMPERATURE: 67°F	UPPER BEAM: 600, 1500, AND 5000 cd. AT H-V. WHITE TURN SIGNAL: 600 cd AT H-V AMBER AND WHITE. DURING SOME OBSERVATIONS A FLASHING AMBER TURN SIGNAL WAS USED. THEN THE INTENSITY WAS 250 cd.	NO SECONDARY TASK. LAMPS ON EACH SIDE OF CAR WERE LIGHTED. OBSERVERS TO JUDGE MOST EFFECTIVE DRL. LAMPS ALWAYS HAD SAME INTENSITY, SOMETIMES DIFFERENT BEAM PATTERNS. A. DYNAMIC TEST. OBSERVERS WERE OFFSET APPROX. 25' FROM CENTERLINE OF PATH OF DRL CAR. OBSERVATIONS MADE 500' TO 250', WHEN DRL CAR WAS DRIVEN AT 30 MPH TOWARD OBSERVERS. B. STATIC TEST OBSERVERS, OFFSET 25' DISTANCE OF 250' AND 500'. C. STATIC TEST STRAIGHT AHEAD DISTANCE .3 MILES.	A. 5000 cd UPPER BEAM JUDGED MOST EFFECTIVE. 600 cd AMBER TURN SIGNAL NEXT. B. 5000 cd UPPER BEAM AND 600 cd AMBER TURN SIGNAL WERE JUDGED MOST EFFECTIVE. C. 5000 cd AND 1500 cd UPPER BEAM JUDGED TO BE MOST EFFECTIVE.

DATE: APRIL 9, 1986 (PAGE 2 of 2)

SITE: SAN DIEGO, CALIFORNIA

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY, TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES, COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC: STRAIGHT AHEAD, OFFSET. PERIPHERAL.	SUMMARY OF RESULTS
		D. STATIC TEST. DISTANCE 500' AND .3 MILES. WILL DRL OVERPOWER A FLASHING AMBER TURN SIGNAL?	D. AT .3 MILES MOST OBSERVERS COULD NOT SEE FLASHING AMBER TURN SIGNAL OF 250 cd FOR ANY REASONABLE DRL INTENSITY. AT 500' 49% OF OBSERVERS COULD SEE 250 cd FLASHING AMBER TURN SIGNAL ADJACENT TO 5000 cd DRL. 80% OF OBSERVER COULD SEE 250 cd FLASHING AMBER TURN SIGNAL ADJACENT TO 2500 cd DRL.

DATE: MAY 6, 1987

SITE: ORLANDO, FLORIDA

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY. TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES. COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC: STRAIGHT AHEAD, OFFSET, PERIPHERAL.	SUMMARY OF RESULTS
DAYTIME: AFTERNOON 13:35 TO 14:30 BRIGHT SUN, SOME BROKEN CLOUDS TEMPERATURE: 90°F APPROX. 100000 LUX IN BRIGHT SUN. APPROX. 40000 LUX WHEN CLOUDS COVERED THE SUN. DUSK: EVENING BEFORE SUNSET. 18:45 TO 19:35 SUNNY, FEW CLOUDS TEMPERATURE: 80°F APPROX. 18000 LUX AT START OF TEST. 3000 LUX AT END OF TEST. SUNSET AT 20:03	AMBER TURN SIGNAL 200, 400, 600, cd AT H-V. FOLLOWING LAMPS WHITE: UPPER BEAM 600, 1500, 5000 cd AT H-V. LOW BEAM 75% VOLTAGE AND 100% VOLTAGE FOG LAMP APPROX. 200 cd AT H-V. ZERO INTENSITY.	ALL TESTS STATIC. A. OBSERVERS OFFSET 20' FROM CENTERLINE OF DRL TEST CAR. TEST TO SIMULATE BEING STOPPED AT AN INTERSECTION. SECONDARY TASK OF LOOKING AT ONE CAR AND JUDGING EFFECTIVENESS OF DRL ON A SECOND CAR IN PERIPHERAL VISION. SECONDARY TASK CAR 34' TO 114' DRL CAR 200' TO 500' PERIPHERAL VISION ANGLES 8°, 9°, 24°, 28°. B. OBSERVERS, STRAIGHT AHEAD. NO SECONDARY TASK DISTANCES OF 500' AND 1000'. JUDGE EFFECTIVENESS OF DRL COMPARED TO NO LIGHTS ILLUMINATED.	A. AT SMALLER PERIPHERAL VISION ANGLES (8° and 9°) THE DRL'S WERE JUDGED TO BE MORE EFFECTIVE THAN AT LARGE ANGLES (24° AND 28°). THE DRL'S WERE JUDGED TO BE EFFECTIVE AT SHORTER DISTANCES THAN LARGER DISTANCES. THE FOG LAMP WAS NOT ALWAYS THE LEAST EFFECTIVE DRL. 5000 cd UPPER BEAM AND FULL LOW BEAM WERE JUDGED "TOO BRIGHT" BY MORE OBSERVERS THAN ANY OTHER DRL. ALL DRL'S TESTED WERE MORE EFFECTIVE THAN ZERO INTENSITY.

DATE: OCTOBER 4, 1988

SITE: KANSAS CITY, MISSOURI

VIEWING TIMES: DAYTIME, DUSK. AMBIENT CONDITIONS: CLOUDY, SUNNY. TEMPERATURE.	LAMPS AND BEAM PATTERNS USED IN TEST. INTENSITIES. COLORS.	OBSERVATION DISTANCES: SECONDARY TASK; STATIC, DYNAMIC STRAIGHT AHEAD, OFFSET, PERIPHERAL.	SUMMARY OF RESULTS
DAYTIME: AFTERNOON 15:35 to 15:57 BRIGHT SUN, CLEAR BLUE SKY. GUSTY WINDS. TEMPERATURE: 52°F OBSERVERS LOOKING SOUTH WEST. DUSK: EARLY EVENING 18:35 TO 18:56 SUNNY AT BEGINNING CLOUDY AT END OF TEST. SUN TOUCHED HORIZON AT END OF TESTS.	CIE TC4.13 BEAM PATTERN 500 cd TO 2000 cd AT H-V. WHITE ZERO INTENSITY	NO SECONDARY TASK. ALL TESTS STATIC. A. OBSERVERS OFFSET AT 20' FROM CENTERLINE OF DRL CAR. DISTANCE 50' TO 500'. B. OBSERVERS STRAIGHT AHEAD. DISTANCES 100' TO 2000'.	A. DAYTIME: 2000 cd JUDGED EFFECTIVE BY MORE THAN 90% OF OBSERVERS. 500 cd JUDGED EFFECTIVE BY MORE THAN 70%. DUSK: BOTH CANDLEPOWER LIMITS GIVEN HIGHER EFFECTIVENESS AT DUSK AT ALL DISTANCES. B. DAYTIME: 2000 cd JUDGED EFFECTIVE BY MORE THAN 80% OF OBSERVERS AT ALL DISTANCES. 500 cd JUDGED EFFECTIVE BY 7% AT 2000 FT. AND 88% AT 100 FEET. EFFECTIVENESS LINEARLY INCREASES AS DISTANCE GETS CLOSER. DUSK: 2000 cd JUDGED EFFECTIVE BY 100% AT ALL DISTANCES. 500 cd JUDGED EFFECTIVE BY MORE THAN 88% OF OBSERVERS AT ALL DISTANCES.