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HEADLAMP DESIGN GUIDELINES FOR MATURE DRIVERS

***Foreword*—**Mature drivers represent an appreciable percentage of the driving population. In 1989, the percentage of drivers of age 50 years and older represented 30% of the driving population. The number of drivers in this age group was on the order of 50 million! Demographic data such as this provides strong justification for giving specific consideration to the needs of mature drivers when developing SAE standards.

***1. Scope*—**This SAE Information Report should be used as a supplement to SAE J1383 (Reference 2.1.1). It is intended to provide additional information which is important to the automotive designer and engineer in the process of designing, developing, and engineering the headlamps of motor vehicles which will take into account the effects of the aging process on the driver.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein.

2.1.1 SAE J1383 JUN90—Performance Requirements for Motor Vehicle Headlamps.

2.1.2 Olson, P.L., "Problems of Nighttime Visibility and Glare for Older Drivers," SAE 881756. Warrendale: SAE (1988).

2.1.3 Yanik, A. J., "Vehicle Design Considerations for Older Drivers," SAE 885090. Warrendale: SAE (1988).

2.1.4 Kornzweig, A. C., "Physiological Effects of Age On the Visual Process," Sight Saving Review, Vol. 24, (1954).

2.1.5 Bhise, V. D., Farber, E. I. and Matle, C. C., "Predicting the Effects of Driver Age on Visual Performance in Night Driving," SAE 890873. Warrendale: SAE (1989).

2.1.6 Arens, J. B., "The Potential Impact of Automotive Headlight Changes on the Visibility of Reflectorized Highway Signs," SAE 870238. Warrendale: SAE (1987).

2.1.7 Bhise, V. D. and Matle, C. C., “Effects of Headlamp Aim and Aiming Variability on Visual Performance in Night Driving,” Trans. Res. Record 1247. Transportation Research Board (1989).

2.1.8 FMVSS No. 108: Lamps, reflective devices, and associated equipment.

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2.1.9 EEC 76/756 Appendix 5: Installation of lighting and light-signalling devices on motor vehicles and their trailers.

2.1.10 ECE Reg. No. 45: Uniform provisions concerning the approval of headlamp cleaners and of motor vehicles with regard to headlamp cleaners.

2.1.11 SAE J852 DEC93—Front Cornering Lamps for Use on Motor Vehicles.

3. ***General—***There are a number of age-related changes that can affect the ability of persons to collect visual information while operating a motor vehicle at night (Reference 2.1.2, 2.1.3). The more important of these are:

a. Reduced visual capabilities at low levels of illumination
b. Increased sensitivity to glare
c. Longer recovery time from glare
d. Decreased visual acuity
e. Longer motor response time
f. Decreased contrast sensitivity

The primary headlamp characteristics specified or referenced in SAE J1383 (Reference 2.1.1) that have an impact on these factors are:

a. Beam candlepower
b. Candlepower distribution
c. Aim

These characteristics and their relationship to the aging process are discussed in the following section.

4. ***Specifics***

4.1 **Beam Candlepower—**One of the primary effects of aging on vision is that less illumination reaches the light-sensitive portion of the eye (the retina). The reduction can be quite large. For example, for the same lighting conditions, the illumination of the retina of an 80-year-old person will be about 10% of that at the retina of a young person (Reference 2.1.4). Hence, older persons need higher levels of illumination. This is most affected by the candlepower that is directed to areas of the forward field where targets are likely to appear (Reference 2.1.5). It is also desirable that more illumination be directed to the "wing" areas to facilitate seeing driveways, close-in curbs, etc.

4.2 **Candlepower Distribution—**The need for increased illumination must be balanced against the fact that the aging eye is much more affected by glare. Disability glare comes about because light entering the eyes of a person is scattered somewhat, producing a veil or curtain of diffused light across the retina and thereby reducing target contrast. The amount of scattered light increases as the eye ages. Thus, it is important that the intensities above the horizontal axis of a low beam headlamp be maintained at reasonably low levels. Of course, sufficient illumination should be maintained for sign detection and legibility (Reference 2.1.5, 2.1.6).

4.3 **Aim—**To provide both enhanced visibility and increased glare protection to the older driver means that areas of relatively high illumination and low illumination in headlamp beam patterns must be maintained in closer proximity. This, in turn, necessitates that aim must be maintained within close tolerances (Reference 2.1.7). Major aspects of proper aim include:

a. Providing proper aim during vehicle manufacture
b. Designing mounting mechanisms that will hold aim securely while the vehicle is in use
c. Facilitating accurate aiming and checking of aim in the field
d. Minimizing aim error when bulbs are replaced
e. Considering auxiliary devices such as manual or automatic aim levelers and load levelers to maintain aim

4.4 Other Possible Assists—These assists help in maintaining proper aim and roadway illumination and in providing additional light in wing areas. They are of benefit to all drivers in all age groups but preferentially to those in the mature driver age group.

a. On-board aimers (Reference 2.1.8)
b. Aim levelers (for loading) as required in Germany (Reference 2.1.9)
c. Headlamp washers with or without wipers as required in Sweden, Norway, and Finland (Reference 2.1.10)
d. Cornering lamps (Reference 2.1.11)

5. Notes

5.1 Marginal Indicia—The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE MATURE DRIVER STANDARDS COMMITTEE